THE

AMERICAN REPERTORY

OF

ARTS, SCIENCES, AND MANUFACTURES.

EDITED BY JAMES J. MAPES,

Professor of Chemistry and Natural Philosophy in the National Academy of Design; Honorary Member of the Scientific Institute of Brussels, of the Royal Society of St. Petersburgh, and of the Geographical Society of Paris; Member of the Lyceum of Natural History of New-York; Honorary Member of the National Academy; Corresponding Secretary of the Mechanics' Institute.

VOL. II.

U.S. GEOLOGICAL SURVEY
18947
1887
LIBRARY

NEW-YORK:

PUBLISHED BY W. A. COX, MECHANICS' INSTITUTE, CITY HALL, AND AT 91 READE STREET;

BY WEEKS, JORDAN & CO. BOSTON; ORRIN ROGERS, PHILADELPHIA; AND FRANK TAYLOR, WASHINGTON, D. C.

AND FOR SALE BY THE BOOKSELLERS GENERALLY.

1841.

THE

AMERICAN REPERTORY

OF ARTS, SCIENCES, AND MANUFACTURES.

No. 1. NEW-YORK, AUGUST, 1840. Vol. II.

For the American Repertory.

ON THE STEAM-ENGINE.

On the application of Steam as a moving power, considered expressly with reference to the economy of Atmospheric and High-Pressure Steam. By George Holworthy Palmer, *M. Inst. of Civil Engineers, London.* Inserted in American Railroad Journal for March and April, 1840.

Treatise on the Steam-Engine. By James Renwick, *LL. D. Professor of Natural Philosophy and Chemistry in the University of New-York. Second edition, revised and enlarged.* 1839.

There are few subjects of equal interest or importance, that have been more discussed than the proper use and economical application of steam as a moving power; yet there is probably no subject on which so many discordant opinions still exist among practical men. It necessarily follows, then, that the subject is not yet sufficiently, because not clearly understood. Contradictory and erroneous opinions are not only held by those whose opportunities for observation or capabilities for comparison have necessarily been limited by circumstances or education, but are adopted and supported by well-informed individuals like the above, who from their peculiar position in society might be reasonably deemed competent judges and infallible authorities, from possessing leisure and the most ample means for investigation; and having seemingly exerted themselves to the utmost, have nevertheless arrived at

the most opposite, and as we shall hereafter show, at equally unsound conclusions—both equally positive—alike erroneous. Theoretical writers ever seem to look at facts according as they favor preconceived opinions, rather than as aids to truth and the only sure guides to proficiency; while the facts themselves are left to be developed by the patient practical mechanic, who, from his limited knowledge, is after many anxious trials the frequent victim of disappointment or loss, or the unthanked and unrewarded instrument of useful improvements—unsuccessful, reviled; successful, defrauded.

The intention of Mr. Palmer, as deduced from his paper, is to discredit the truth of the reported duty of the Cornish pumping engines, and to totally deny the great value of high steam when used expansively in those or any other engines; for he says, (p. 183) "How then a saving of fuel can arise from the use of high-pressure steam worked expansively, is to me an evident paradox; unless by some power utterly beyond my comprehension, the sensible caloric can be prevented from becoming latent by dilatation, which, I need scarcely add, no power can accomplish."

Prof. Renwick, on the other hand, not only admits the truth of the Cornish reports, and the great value of high steam when thus applied, but recommends its general adoption in steamboats, &c. in a manner and to an extent which it is one of the express purposes of the present paper to show is dangerous and unnecessary; and being so, is impolitic; and the reasons for these assertions will be hereafter apparent in this our endeavor to separate prejudice from intelligence, by the substitution of certain facts for uncertain theories or groundless conceit.

If Mr. Palmer's treatise (having been published by the London Institution of Civil Engineers) is to be considered as possessing the approval of that respectable institution, and his arguments as having obtained their sanction, then the work must be considered one of the most extraordinary ever recorded by a society of practical men; its sole purpose being to ridicule and to discredit, by most labored theoretical and unfounded speculations, (by any thing and by every thing but facts) the published monthly reports of the duty of the Cornish pumping engines,

and to prove by an immense collection of heavy and unsound arguments that it is physically impossible the Cornish reports can be true; while, unluckily, it will be seen Mr. Palmer having been physically mistaken, the Society will have lost all the credit and honor anticipated in this publication of what, Mr. P. says, is "above his comprehension."

Prof. Renwick, on the other hand, too ingenuous to deny such public and authentic statements, and too well informed to question them, has elucidated in detail the causes of the superiority of the Cornish engines; and these causes are no where better described than in his work: (see articles, 110 to 115.) But as he also has mistaken the nature of steam and its value; as he has also too hastily, though ingeniously, assumed that improvements so palpable and so useful in the Cornish pumping engine, can be as readily imparted, and as extensively and usefully applied to the rotary or crank engines, he has thus promulgated errors; which being sanctioned by his respectable name, supported by his otherwise useful work, may be attended with very injurious effects to the future improvement of the steam-engine, and discredit to the national talent.

Hence then, were we to inquire for the causes for these opposite views and the contrary deductions of these writers, we should probably first seek it in the actual difference to be found in the action of steam in the pumping engine and in the crank engine—an important fact; unknown to each, because unnoticed by both; and yet it is a fact of no mean importance to any one attempting a description of the steam-engine, and of great importance to any one attempting its improvement; and if we were to extend our inquiries in a full and unprejudiced manner, we probably should soon discover sufficient additional cause for their opposite views in the many different opinions that have prevailed on the nature and essential properties of steam, and which have originated and continued very singular and capricious prejudices.

It is well known that the most extraordinary and incredible properties have been attributed to steam by earlier writers, who unhesitatingly asserted that while the expenditure of fuel increased in an arithmetical, the force of steam increased in a

geometrical ratio. Hence the most extravagant advantages were expected and promised by Evans, Perkins, and Wolfe; advantages, unfortunately, which could never be realized, because they never existed.

If we inquire further, how such talented men could ever have been thus mistaken, we may find their best, and perhaps only excuse, in the seeming vastly increased effect of heat on the thermometer, as indicated in the tables published by chemical writers on the elasticity of steam. Thus Dr. Ure states, though the temperature of water must be raised 180°, or from 32 to 212, to produce steam equal to 30 inches mercury, that only

36°	are	required	from 212 to 248	to	equal	30 inches mercury.
24°	"	"	248 to 272	"	"	"
18°	"	"	272 to 290	"	"	"
15°	"	"	290 to 305	"	"	"

MM. Dulong and Arago carry their tables to fifty atmospheres, and state that towards the end of their observations a *single* degree of heat increases the elasticity of steam equal to thirty inches mercury. Now, this seeming great effect of heat on the thermometer, indicating intensity only, was doubtless mistaken for quantity; and increased power was thence inferred without further inquiry. Hence there arose the unfortunate delusion that overwhelmed so many minds for so many years; and this baseless speculation has unquestionably hindered the application of rational and practical, because apparently less splendid endeavors; and hence the improvement of which the steam-engine is still susceptible has probably been retarded, and is still thereby prevented.

These overexcited opinions have generated and still maintain in this country, as undue a prejudice in favor of high steam, as the unfortunate failure of the hopes they gave rise to has created an equally undue prejudice in favor of low steam in England, over a great portion of the most influential practical engineers, of which sufficient and indubitable evidence is given by this publication of Mr. Palmer's speculations, sanctioned by the British Society of Civil Engineers.

Hence then we have obtained the probable origin of the very opposite opinions embraced and prejudices exhibited by the

writers at the head of this paper, on a subject, mechanical and physical, and therefore as certainly susceptible of such full explanation as will allow of neither dispute nor misapprehension, whenever it shall be fairly and carefully investigated, without national prejudice; which, mean and pitiful as it is on personal subjects, is miserable on this.

The first inquiry in this matter should now be, as it always should have been, what is the real nature of steam of various densities? as so many opinions have been given, and are still maintained thereupon, and as a previous knowledge of the true properties of steam is evidently as attainable as it is indispensable to a right discussion of its proper application. Its correct analysis will prove that all former and all prevailing errors have arisen from a want of that definite and certain knowledge of this branch—or rather root—of the subject; for contrary to all previous authorities we maintain, and will speedily prove, that steam in every proper state and density, when rightly applied to produce motive power, is a definite compound of water and of heat, ever in an active, sensible, or free state, and never in a latent, or insensible, or combined state, as it is in the permanent gases of oxygen or hydrogen; but a compound at once and always simple, wherein the rate of the elements is definite or invariable.

By proving this, we shall clear our subject from a load of superfluous arguments which each writer has based on erroneous and mistaken notions of this invariable property of steam; and as it is essential that we show this fact fully and clearly, we shall proceed to do so by an experiment which may be easily made or repeated, at little trouble or expense, by any of our readers. We shall detail it fully, to prove our position; and it will seem not a little curious that this experiment of ours differs but a little, in its detail only, from the experiment quoted by Mr. Palmer in the commencement of a paragraph, wherein he draws so melancholy, so unfounded, and such a contrary conclusion, which there appears to have been the source of his many errors. How easily, then, may such mountains be removed!

Provide a small wooden tub or cistern, with a moveable

wooden cover; coil about 10 or 12 feet of very small leaden pipe, spirally on the bottom of the cistern, passing the ends of the pipe through, and cementing them into opposite sides of the cistern: connect the upper end of the pipe by a small stop-cock to a high-pressure steam-boiler. If then a full cubic foot of cold water is introduced into the cistern, its depth and temperature observed and noted, by a regulated opening of the stop-cock some exact measure of water may be distilled through this apparatus, (as a pint) and the heat and water in steam of any and every density may thus be separated and correctly measured; as the distillation of a constant quantity of water by measure will always impart to the condenser one constant corresponding elevation of temperature, from steam of any and of every density, whether 1 lb. or 10 lbs. or 50 lbs. or 100 lbs. per inch above atmospheric pressure. The quantity of heat obtained from a constant quantity of water will be also always an invariable corresponding quantity.

Now, the true composition of steam of 1 lb. per inch cannot be misstated, when assumed to be steam of much higher elasticity greatly expanded; and as we have proved no heat is lost, or has become latent or insensible during the expansion of steam, contrary to the assertion so fully and so unreservedly made by Mr. Palmer, and as certainly though in a very reduced or humble degree by Mr. Renwick, yet equally erroneously by both—we see their joint errors are founded alike on a misapprehension of the true nature of the heat in steam, in which none can be lost or become latent with any degree of expansion within a steam-engine, because *heat never becomes latent in steam at all.*

Trusting that enough has been proved to show both the origin and excuse for the errors of the earlier writers, in their unfounded anticipations of unlimited advantages from the use of high steam, we will next endeavor to show the origin and excuse for the mistaken views of the authors at the head of this paper, and at the same time remove an incubus that has long pressed so heavily on, and retarded so much the advancement of this particular branch of science.

Probably in the first instance our observations will be met with doubt, or denial, or both, from many who are governed,

as the greater part of mankind are, more by the authority of great names than by reason; as in the case now immediately contemplated, where a humble individual presumes to question the discernment and discrimination of every chemical writer and philosopher on the subject and nature of steam, from the time of the venerated Dr. Black to the present period. But although it may, and doubtless will appear to most chemical readers an almost absurd position to question the assertion first made by Black, and since universally admitted by all writers on the subject, yet it must be allowed, *à priori*, that if an error has crept into the theory of steam on such high authority, and has been sanctioned so long a time, by so many learned and acute writers, and by such a host of talented and practical men, then the removal and exposition of such an error must be considered as an imperative duty devolving on the first individual, however humble he may be, that shall first and clearly detect it. Considering then this duty has devolved on us, we proceed to explain our views, by inquiring into the doctrine of LATENT HEAT, as expounded by that highly gifted individual Dr. Black, who taught that ice in melting absorbed 140° of heat; and that as the temperature of a thermometer embedded therein remains invariable during the whole period of melting, however long that period may be protracted, the great quantity of heat thus absorbed by the melting ice becomes latent, or hidden, or insensible; yet it is alone to this application of the latter term, or insensible heat, that no contradiction is or can be contemplated.

Again. When an immensely larger proportional quantity of heat is combined with the elements of water, to form the *permanent* oxygen and hydrogen gases, the term latent heat is more strictly applicable, because though the heat in combination exists in such a greater quantity, the gases may be exposed to an immensely greater range of temperature, or to any degree of cold, without disturbing the chemical and permanent arrangement of the heat with the ponderable elements in the gases. Now, we allow the term insensible heat to correctly designate the heat in melted ice or water, and the term latent heat as properly to designate the heat combined with oxygen and with

hydrogen, and forming those permanent gases, yet we are not only disposed to question the existence of heat as latent or insensible in steam, and the propriety of those terms, but to deny the existence altogether of any other than free heat in steam of any density whatever and wherever; for is it not perceptible to the sense of feeling, appreciable and measurable by the thermometer; and not only perfectly free, but ever prone or ready to enter into instantaneous combination with any colder substance with electrical rapidity, its speed limited alone by the conducting power or capacity of any such substance with which it comes in contact? Can anything be conceived more contrary to reason than the idea that the heat in steam is ever latent or insensible? Can any thing be more contrary to sensation, to experiment, and to fact?

Yet from views so mistaken, with arguments so unfounded, Mr. Palmer has not only attempted to retard the improvement of the steam-engine, but has had the hardihood to deny facts as notorious as the sun at noon-day. Well has he said, "it is above my comprehension." We can see no possible reason to doubt this his assertion; but we do see reason to doubt Mr. Renwick's assertion, article 115, "The expansion of steam is not inversely as the pressure is;" and we have two reasons for thus doubting Mr. Renwick: the first, founded on the fact we have proved, that the heat in steam is always free and active, and constant in quantity; and the second reason is deduced from an experiment easily made, and which we propose to describe in our next paper. † †

For the American Repertory.

LYCEUM OF NATURAL HISTORY.

PROCEEDINGS.

May. Dr. Quin made a few remarks upon the report of the Committee of Arts and Manufactures, on the electro-magnetic telegraph of Mr. Morse. Mr. W. C. Redfield presented the 52d Annual Report of the Regents of the University of the State of New-York. The Treasurer laid before the Society the London and Edinburgh Magazine, No. 89, and the American Journal

of Arts and Sciences, Vol. 36. Mr. A. R. Thompson presented the 3d Geological Report of the state of New-York. Mr. Halsey presented for distribution the seeds of the colza or braassica—extensively cultivated in Europe for the purpose of extracting an oil with which it abounds. The oil obtained from this plant is said to be equal in illuminating power to whale oil, and can be afforded at a much lower rate.

Peter A. Jay, Esq. Dr. B. W. Budd and D. E. Wheeler were elected resident members; and Charles Fox, of Saugatuc, Ct. and Count Castelnau, of Paris, corresponding members.

June. Dr. Jay called the attention of the Society to plate 7, fig. 1, of his catalogue of shells. The shell there figured is referred to the genus bulimus: he now thinks, from the examination of better specimens lately received, that it belongs to the genus paludina. The President presented a specimen of calcareous alabaster from the great cave, Schoharie, N. Y.

The following works were received from the Royal Society, London: Philosophical Transactions, parts 1 and 2, for 1838; List of the Members for 1838; Proceedings of the Society from 1831 to 1836 inclusive; An inquiry into the nature of Numerical Calculations; Notes on Early Calendars; An Address delivered before the Royal Society, by the Duke of Sussex. Dr. Smith presented the 3d Geological Report of the State of New-York. The London and Edinburgh Philosophical Magazine, No. 90, the Magazine of Natural History No. 29, and Natural History Illustrations No. 1, were laid upon the table. Count Castelnau presented: Mineralogie, by J. G. Wallerius, 2 vols. and Mineralogie, by V. de Bomare, 2 vols.; Manuel de Trigonometrie, by de la Grieve. Mr. Whittemore presented two very minute shells: referred to Dr. Jay for examination and report. The eggs of 21 species of the birds of Massachusetts were received from S. Cabot, Esq. Boston. The President presented a medal commemorative of the completion of the Erie Canal. Mr. Brownne presented specimens of the hottonia inflata, found in wet places on the hills near Hoboken.

July. Dr. Smith made some observations on the tumuli lately opened in Kentucky. The structure of these monuments of

antiquity show in a very striking manner that their builders were unacquainted with the first principles of architecture.

The President gave an account of a tumulus on the St. Lawrence, which was opened in his presence: in it were found two or three skeletons, a number of copper trinkets, and some stones, which from their shape appeared to have been intended for musical instruments. The Indians in the vicinity soon found out a mode of producing from them sounds somewhat harmonious. Some of these stones are at present in possession of the Historical Society of this city.

Count Castelnau presented the following works: Elemens de Mineralogie, par M. le Sage; Essai sur l'étude de Mineralogie, par Rozier; Système Sexuel des Végétaux, par Charles Linné. Mr. Wood presented the Third Annual Report of the New-York Institution for the Blind. Mr. Morris presented: Reports of the Institution for the instruction of the Deaf and Dumb, embracing a period of eight years; A Compendious View of the remarkable facts and recent discoveries in Electro-Magnetism and Magneto-Electricity; Observations on the Education of the Deaf and Dumb; and also the following minerals: kyanite in gneiss, garnets and kyanite in gneiss, augite, apatite, and bog iron ore.

Dr. Brinckerhoff, of the U. S. Navy, presented a number of specimens of natural history, collected in South America and the Pacific during the cruise of the North Carolina. The thanks of the Society were voted to him for his valuable donation, and the following gentlemen appointed a committee to examine and report upon them: Dr. J. C. Jay on the shells; Dr. Quin on animals; Mr. Halsey on plants, fruits, &c.; the President on the minerals; and Dr. De Kay and Mr. Cozzens on the crustacea. Dr. Swift presented four specimens of basalt from the island of San Lorenzo, Pacific Ocean. Mr. W. C. Redfield laid before the Society a pamphlet, entitled "A Letter to the Secretary of the Navy, on the History and Causes of Steamboat Explosions, and the means of Prevention."

Mr. Halsey exhibited a living specimen of the harlequin beetle (acrocinus longimanus) found in Brooklyn, but a native of Cayenne. Prof. Huston of the U. S. ship North Carolina, presented

a mass of conglomerate from Huaco, S. America; also, a mass of salt from the coast of Arica, South America. Mr. S. F. B. Morse presented two specimens of cerographic engraving.

The Librarian laid upon the table the London and Edinburgh Phil. Mag. No. 91, Magazine of Natural History No. 30, and the American Journal of Arts and Sciences, Vol. 36, No. 2. Messrs. E. Dumaizaud and Charles E. West were elected resident members.

August. No meetings.

September. Dr. De Kay exhibited specimens and read a description of a crustaceous animal from West Canada Creek, N. Y. more nearly allied to the trilobites than any heretofore described: he proposes to call it fluvicolor. Mr. J. H. Redfield presented specimens of lymnæa stagnalis, and a melania, (believed to be a new species) from Congress Lake, Ohio. The Librarian laid upon the table the London and Edinburgh Phil. Mag. Nos. 92, 93, 94, 95, Mag. of Nat. History Nos. 31, 32, 33, and the American Journal of Arts and Sciences, Vol. 37. Mr. W. C. Redfield presented "Remarks on Mr. Espy's Theory of Centripetal Storms."

The 2d Geological Report of the State of Ohio was received from Dr. J. P. Kirtland, of Cleveland, Ohio; and Tracts on Docks and Commerce, from Mr. Vaughan of London. Dr. Gale presented a number of specimens of minerals, most of which were from the boulders of this island. Mr. Audubon presented "Synopsis of the Birds of North America." Dr. Swift presented specimens of gypsum from Ithaca, N. Y. A number of minerals and fossils, from Cayuga county, were received from Prof. Dewey. Dr. G. W. Hulse, of Mississippi, presented a specimen of madreporite hornstone, from Orange county, N. Y.

October. The Reports of the Council and Auditors of the Zoölogical Society of London, and their Proceedings, were received from the Society. Dr. Brinckerhoff presented a number of minerals and geological specimens from Westchester, and three shells from the Pacific Ocean: the shells were referred to Dr. Budd for examination. Mr. Thompson exhibited a specimen of fucoides from Medina, N. Y. Dr. Jay reported

upon the shells, and the President upon the minerals and geological specimens, presented by Dr. Brinckerhoff in July.* Mr. Cozzens presented two specimens of kyanite from this island. The Boston Journal of Natural History was received.

Dr. C. A. Lee and Mr. F. Faucet were elected resident members; and J. P. Kirtland, of Cleveland, Ohio, a corresponding member. B.

BRITISH AND AMERICAN MARINE ENGINES.

To the Editor of the American Repertory:

Sir—In the April number of the American Railroad Journal is a communication, in which the author attempts to make a comparison of the consumption of fuel between "the British engines which use low steam, and some of the engines of the fastest running American boats," the particulars of which are given in a table. From this table I wish to select, as the subject of my present remarks, the steam-boat Rochester, for the reason that an estimate of the power of the engine of this vessel is also given in the April number of the London "Civil Engineer and Architect's Journal," in comparing the amount of power in proportion to the immersed cross section of the vessel in British and American steamers.

In the table mentioned above, the author states the power of the Rochester's engine equal to 160 horses; but the writer in the Civil Engineer gives as the result of his estimate the power equal to 985.463 horses. Here, certainly, is no small discrepancy.

One reason of this great difference may probably be found in the different objects which appear to be kept in view by these two writers. The author of the first named, judging from the general tenor of his remarks, wishes to prove the superior economy of the British marine engine, when compared with the marine engine of this country; the object of the latter is to show that "the London engineers are not only capable of constructing engines which would propel vessels at the rate of 16.55 miles

---

* For the Reports, see Silliman's Journal, Vol. 38, p. 198.

an hour, but they can obtain that result with less than $\frac{9}{11}$ths the power employed by their transatlantic brethren." And it must be allowed that both have succeeded most admirably. Having made these few preliminary observations, I shall now attempt—

1. To exhibit the different result that will be obtained in both cases by applying the power of the engine as given by one of the writers, to the object (which appears to be) kept in view by the other; or in other words, in comparing the British and American marine engines with regard to their economy in the consumption of fuel, we shall suppose the power of the Rochester's engine to be 985.463 horses power, instead of 160 horses power; and in comparing the amount of power in proportion to the immersed cross section of the vessel, *vice versa*.

2. To give an estimate of the power of the Rochester's engine that shall approximate somewhat nearer its *true power* than either of the foregoing.

3. To make a more correct comparison between the British and American marine engines with respect to their economy in the consumption of fuel.

And first, the amount of wood consumed by the Rochester, as given in the table, is three cords per hour; which is considered by the author equal to 3290 lbs. Liverpool coal; which, divided by 160 horses power, gives 20.56 lbs. coal per horse power per hour: whereas the Great Western is stated to consume but 6.75 lbs. and the Liverpool 5.75 lbs. per horse power per hour; but if we divide the 3290 lbs. by 985.463, we have 3.34 lbs. per horse power per hour, which instead of being $3\frac{1}{2}$ times the amount consumed by the Great Western and Liverpool, is but about one half.

Again. The writer in the Civil Engineer, in comparing the power of the British steam vessel Ruby with that of the Rochester, arrives at the conclusion that the gross power required to propel a vessel of the size of the Rochester at the same velocity at which she is driven by her present engine would be, if built on the same plan and as perfect as those of the Ruby, 892.46 instead of 985.463 horses power; or in the words of the author, "the amount of power absorbed by friction, and other losses, is

thus on the principle of the Ruby's engines 185.19 horses power, and on that of the Rochester 397.03 horses power." But if we assume the power of the Rochester's engine to be equal to 160 instead of 985.463 horses, as stated by this author, the result will be as follows:

The area of the Rochester's immersed midship section, as given by the writer in the Civil Engineer, is equal to 96 square feet; and that of the Ruby 65.6 square feet. $\frac{65.6 \times 160}{96} = 105$ horses power, required to propel the Ruby at the same velocity at which the Rochester is driven. But the speed of the Rochester is 16.55 miles per hour; whereas that of the Ruby is but 13.5 miles. Then the power of the Ruby will be less than 105 horses in the ratio of the cubes of their respective velocities, or $\frac{13.5^3 \times 105}{16.55^3} = 81.3$ horses power, instead of 100 horses, the power of the engines by which the vessel is now driven; consequently there is 18.7 horses power lost in the Ruby's engines above the amount that would be lost were the engines of the same construction as that of the Rochester, either from greater friction or malconstruction.

The results of the above calculations certainly appear very different from the results given by the respective authors, and are probably quite as near the truth.

In estimating the power of the Rochester's engine, the data that we shall make use of are either received from the engineer of the vessel, or the result of personal observation: they also refer to the time when the Rochester had a cylinder of 43 inches diameter: this has since been taken out, and replaced by one of 50 inches diameter.

The cylinder is 43 inches diameter, the area of which is 1452.2 sq. inches, with a stroke of 10 feet, and the crank makes 25 revolutions per minute: hence the velocity of the piston is equal to 500 feet per minute. The pressure of steam maintained in the boiler above the pressure of the atmosphere is 45 lbs. per sq. inch; to which add 11 lbs. for the vacuum upon the opposite side of the piston, we have 45 lbs.+11=56 lbs. per square inch for the gross pressure upon the piston. The engine work-

ing expansively, the steam is cut off at 38 inches, or allowing two inches for the clearance of the piston and space occupied by steam in the steam chest, say 40 inches or one-third of the stroke, the average pressure will then be 31.6 lbs. per sq. inch nearly; but from this we must deduct say 2.6 lbs. for the loss by the wire-drawing of the steam and maintaining the cylinder at the temperature of the steam which enters it from the boiler, also 9 lbs. per sq. inch for the friction of the engine, we have then $31.6-(2.6+9)=20$ lbs. per sq. inch as the whole effective force of the steam upon the piston.

If then a=area of cylinder, p the effective pressure upon the piston in lbs. per sq. inch, v the velocity of the piston in feet per minute, and h the value of 1 horse power in lbs. raised one foot high per minute, the power of the Rochester will be $=\frac{a\,p\,v}{h}$ or substituting the known value of these quantities, we have $\frac{1452.2\times 20\times 500}{33.000}=440$ as the horses power of the engine, which is probably not far from the truth.

We now come to the comparison between the British and American marine engines in point of economy in the consumption of fuel. And here also the data with respect to the Rochester were received from the engineer: the particulars of the Great Western and Liverpool are extracted from the table mentioned in the first part of this article.

Name of the Vessel.	No. of Engines.	Diameter of Cylinder.	Length of Stroke.	Power in Horses.	Cords wood per hour.	lbs. per hr. Liv. coal.	lbs. coal pr hr. pr horse pow.
Rochester.....	1	43 in.	10 ft.	440	2.4	2400	5.48
Great Western..	2	73½ in.	7 ft.	400		2700	6.75
Liverpool.....	2	75 in.	7 ft.	460		2645	5.75

We have here assumed one cord of wood equal to 1000 lbs. Liverpool coal, as this has been found from experiment very near its true value. It will be seen from the above, that if the consumption of fuel in the Rochester be called 1, the ratio of the Liverpool is 1.047, and the Great Western 1.25.

In attempting to make the foregoing comparison of the consumption of fuel, I have selected the Rochester, as in the table given by the writer in the American Railroad Journal the consumption is shown to be greater on board this vessel, in proportion to the power, than any other mentioned.

As before stated, the amount of fuel consumed on board the Great Western and Liverpool is taken from the table mentioned; but this amount is not so great as the actual consumption on board these vessels by about 300 lbs. per hour.

If not extending this article too much, I may perhaps here be allowed to state for the information of the writer in the Civil Engineer, that in the American practice there is no nominal horse power given for marine engines, by which to be able to compare them with others; but contracts are made for some given diameter of cylinder and length of stroke; and in some cases the dimensions of the boiler or boilers are also specified.

MIRON.

Philadelphia, July, 1840.

A. M. PERKINS'S STEAM-GUN.

The use of steam instead of gunpowder was suggested almost as soon as the completion of the steam-engine; but it was supposed that as combustion of powder produced a pressure of 500 or more atmospheres, it would be impracticable to overcome the obvious difficulty of want of strength in boilers, &c. necessary to make steam available for such purposes; and thus for a time scientific men were deterred from experimenting on the subject.

In 1824, our gifted countryman (Mr. Jacob Perkins) constructed a generator for highly elastic steam; and from its construction he was enabled to pursue his experiments without danger. The principle of its safety consisted in subdividing the generator and steam receptacle into small apartments, either of which could explode without endangering the whole apparatus. This application is thus described by Mr. Perkins himself:—

> Fill an ordinary steam boiler with gunpowder, set fire to it, and imagine the effect! Divide the same boiler into numerous small compartments or cells, and with a torch in your hand you may set fire to the powder in each cell successively without fear.

Not long after the construction of this generator, Mr. Perkins discovered the fact that the high-pressure steam of his ordinary boilers in daily use possessed sufficient elastic force for the purposes of gunnery. He therefore immediately constructed a

gun, which he attached to his generator, the first trial of which fully realized his expectations. We will here again give his own explanation of the apparent paradox:

It was found upon trial and comparison, that steam at a pressure of only 40 atmospheres produced an effect equal to gunpowder; whereas it was known that the combustion of gunpowder was attended with a pressure of from 500 to 1000 atmospheres. Mr. Perkins afterwards gave a satisfactory explanation of this apparent discrepancy, by referring to the small effect produced by fulminating powder compared to gunpowder, although many times more powerful. He supposes that the action of fulminating powder, however intense, does not continue sufficiently long to impart to the ball its full power, or that the inertia of the ball at the moment of starting opposes sufficient resistance to neutralize in a considerable degree the sudden impulse of the explosion. The explosion of gunpowder, although not so powerful at the instant of ignition, is nevertheless in the aggregate productive of greater effect than that of fulminating powder, because the subsequent expansion continues in action upon the ball (but without decreasing effect) until it has left the barrel. The action of steam differs from either of these agents, inasmuch as it continues in full force until the ball has left the barrel; and this is the cause of its superiority.

The bow is a familiar illustration of this principle. In this instrument the propelling power is so extremely slight, that it may be resisted by a child; and yet the feeble action of the string, by following up the inert arrow until it has imparted to it its own velocity, sends it forth at last with wonderful effect.

In the year 1826, Mr. Perkins had so far perfected the mechanism of the gun and generator, that at an exhibition and trial of its power in the presence of the Duke of Wellington and other distinguished officers of the ordnance department, balls of an ounce weight were propelled at the distance of 35 yards through an iron plate one-fourth of an inch in thickness; also through eleven hard deal boards one inch in thickness, placed at the distance of an inch from each other. Continuous showers of balls were also projected with such rapidity, that when the barrel of the gun was slowly swept round in a horizontal direction, a plank twelve feet in length was so completely perforated, that the line of shot holes nearly resembled a cut from one of its ends to the other.

Mr. Perkins has since constructed for the French government a piece of artillery which discharged balls weighing 5 lbs. at the rate of 60 per minute. From the experiments made with this gun, it was estimated that 1 lb. of coals would discharge as many balls as 4 lbs. of powder.

He afterwards constructed the steam-gun exhibited at the Adelaide Gallery, London.

This ingenious application of steam has led to many definite rules for calculating its power and properties.

Without in the slightest degree animadverting upon the ingenuity and talent of Mr. Perkins, we cannot withhold the remark that the fact of its not having been brought into use as an instrument of warfare by the British government, is highly creditable, and clearly proves that we are fast emerging from the barbarities of the earlier ages.

The present gun lately exhibited in New-York was constructed by Mr. A. M. Perkins, and differs principally from the original in the method of generating steam, which is produced by "the generator," spoken of in another part of our number.

We extract the following account of the gun and generator, from a pamphlet entitled "A Brief History of A. M. Perkins's Patent Steam-Gun and Newly-Invented Apparatus for Generating Steam by the circulation of Hot Water."

The gun, except in a few minor mechanical details, does not differ from that originally constructed by Mr. Jacob Perkins. The novelty which distinguishes the generator from all others, consists in the manner of conveying the heat from the fire to the water, without exposing the generator to the action of the fire. This is accomplished by means of the circulation in iron tubes of a current of hot water, which is entirely separate from and independent of that to be evaporated in the generator. The apparatus by which the heat is thus transferred is exceedingly simple, and will be easily understood.

An iron furnace is used, containing a continuous coil of iron tubing, 1 inch in external, and $\frac{5}{8}$ of an inch in internal diameter, and 80 feet in length, within which the fire is made. The upper end of this tube, called the flow pipe, is extended any required distance to the top of the generator.

The generator is composed of a strong iron tube, 3 inches in diameter and 6 feet in length, within which are eight smaller tubes, whose ends are welded to the ends of the large tube: these tubes communicate at the top with the flow pipe, and at the bottom with the return pipe, which is continued to the bottom of the furnace coil.

The furnace coil, the smaller tubes, the flow pipe and the return pipe are filled with water by unscrewing the cap upon the pipe, after which the cap is replaced and the apparatus becomes completely closed in all parts.

On top is a pipe of larger diameter than the hot-water tubes, called the "expansion pipe." It is quite empty when the apparatus is cold; but the water when heated undergoes considerable expansion or increase of bulk; and if closely confined, would burst the strongest tube before its temperature reached the boiling point. To guard against such an accident, the expansion tube is made more than sufficiently large to contain all the water that may be expelled by expansion.

The circulation in the tubes is occasioned by the difference in the specific gravities of the water composing the ascending and descending

currents: that portion contained in the flow pipe and fire coil becomes rarefied as its temperature is increased, and ascends by its superior levity, while that portion contained in the small tubes having given off its heat, acquires increased density, and descends through the return pipe to the bottom of the furnace coil, to take the place of the ascending current. When the hot water current has arrived at a temperature of 212° and upwards, water is injected into the generator by means of the force pump, and becomes converted into steam by its contact with the small tubes. The rapidity of evaporation will of course depend upon the temperature of the hot water current. It has been found by experiments, that the apparatus here described will easily evaporate a cubic foot of water per hour when the flow pipe is kept at 400°. A temperature of 500° will cause a pressure within the tubes of 50 atmospheres, and if there be sufficient water in the generator to abstract the heat from the small tubes, it will acquire a temperature and pressure nearly corresponding, some allowance being made for radiation. As this is the maximum pressure at which it is ever necessary to work the generator and tubes, it will be seen that they are kept far within the limit of safety, since the whole apparatus is previously proved to be capable of sustaining a pressure of 200 atmospheres.

The following are the principal advantages which this generator possesses over all others. Freedom from all wear or deterioration which is consequent upon exposure to the fire. This is an important quality in a generator which is to be constantly subjected to great pressure, inasmuch as its original strength remains ever afterwards unimpaired. No accident can arise from want of water in the generator; and the precautions which are indispensably necessary when the generator is in contact with the fire are quite useless, as the water may at any time be drawn off with impunity, without producing any other effect than that of cooling the generator: hence all guages and other contrivances for ascertaining the level of the water are superfluous, and the grossest neglect is followed by no worse consequence than an inefficient supply of steam. An explosion of the generator is impossible, because, as before remarked, the temperature of the furnace coil always exceeds that of any other part of the apparatus; consequently the fire coil is the weakest part, and is invariably the first to yield when the pressure is carried beyond the strength of the pipes. Economy of fuel is obtained with a small amount of fire surface. The rapid abstraction of heat by the circulating current has been strikingly exemplified by the following experiment: If melted lead be poured upon any part of the circulating tube when at a temperature of 350° or 400° (a temperature sufficient to melt an alloy of tin and lead) it will instantly become congealed; whereas if a like quantity be poured upon a cold tube, in which there is no circulation, it will remain a considerable time before passing into a solid state. The circulation of the water has likewise the effect of preserving the fire coil from the decay to which boilers are liable: many such coils which have been in constant use for eight years, are apparently as good as when first erected.

The furnace is provided with a heat governor or regulator, by which the intensity of the fire is always proportioned to the temperature which it may be required to maintain in the tubes.

It has been found by experiments with this gun, that the generator is capable of furnishing a constant supply of steam for discharging balls at the rate of 60 per minute, and that one pound of anthracite coal will generate steam sufficient to discharge four pounds of balls. The steam has often been raised to a pressure of 700 lbs. per square inch; but one third of this pressure is sufficient to completely flatten the balls when discharged against an iron target 100 feet distant from the gun, and a pressure of 400 lbs. per square inch at the same distance shivers the balls to atoms.

Steam guns, as originally constructed by Mr. Perkins, are mounted upon a ball and socket joint, which allows the barrel to turn freely in every direction; but to make sure against accident, it has been thought advisable to dispense with this appendage in a gun intended merely for exhibition.

We are mortified at recording the fact that this most interesting exhibition has left our city almost unnoticed, and the enterprising individual who brought it from London has undoubtedly lost a large sum by his enterprise. We know of no exhibition which has visited our city for many years so well calculated to instruct our practical mechanics in the peculiar properties of steam.

A. M. PERKINS'S PATENT STEAM-BOILER.

Our readers will doubtless recollect the plan proposed by Mr. Perkins for warming buildings by the circulation of hot water, under pressure, in wrought-iron tubes. Since the introduction of the above named apparatus, (which is now in successful use) Mr. P. has applied the same principles to generating steam for practical purposes; and from the report of Josiah Parkes, Esq. on this new application, it appears to have completely succeeded.

By this method of producing steam no fire is used under the boiler, the water being heated by wrought-iron pipes filled with hot water under great pressure, being entirely filled, and no space left for the formation of steam within them.

Sixteen sets of these pipes were used in the experiments made by Mr. Parkes, each set being entire within itself, leading from and returning to the fire, their opposite ends passing through the steam boiler or generator, and there parting with the caloric taken from the fire.

By the annexed quotations taken from Mr. Parkes's printed Report, it is shown that the quantity of fuel necessary to create a given quantity of steam is no greater than with the ordinary method; and the advantages of being able to use small boilers with large generating surfaces, without the slightest danger from the absence of water in the generator or recipient, are too evident to need comment.

The rapidity of the circulation, or, perhaps it would be better expressed, the velocity of the current of heated water in the pipes must be very great, as in each of the 16 sets there is only half a gallon of water; and this slender thread of water, half an inch in diameter, traverses 48 lineal feet in its process of absorbing and imparting caloric. It appears to me, that each particle of water must either be in a state of inconceivably rapid motion, or that its power of conduction, when under pressure, must be far greater than that of water in its natural state, or, indeed, than any vehicle of caloric with which we are acquainted. If the water be not in motion, the heat imbibed by it must be transmitted from particle to particle with electric velocity; but we know the conduction of heat by water to be effected by change of place amongst its particles, which is motion.

The rapidity of this motion within the pipes of your boiler is practically exemplified by the production of steam in the recipient, for no appreciable time seems to be occupied in the transfer of caloric; a sudden increase or diminution effected in the temperature of the furnace, seems to be propagated to the water in the recipient as quickly as if the recipient itself were exposed to the fire. I am the more particular in stating this fact, as upon it depend several matters of consequence in practice. The inspection of a drawing or model would have induced me to think that the production of steam could neither be accelerated nor checked so quickly in this as in common boilers; but I am able, from the conduct of the experiments, to assert that in these important practical respects there is no difference between them. The fire and generation of steam are under the same control by the damper in your boiler as in those of the ordinary construction.

In the absorption and transfer of heat by the pipes of the boiler experimented upon, another remarkable phenomenon presented itself, viz. that 44 square feet of pipe imparted to the water in the recipient the whole of the heat taken up by 117 square feet exposed to the fire; and, as it was ascertained that the heat entered the chimney at a higher temperature than that of the steam, we know the absorbing surface to have been in every part of it hotter than the water in the recipient. This proves water to be a much better conductor of heat than iron, for an equal surface of water has abstracted from the iron pipes 2.6 times more heat than the pipes have absorbed from the fire in the same interval of time. It seems indeed probable, from some experiments which you communicated to me, and which induced you to assign these proportions of absorbing and transferring surfaces, that an equal effect would be produced with a somewhat less proportion of the latter surface.

From the tables accompanying the Report, it would seem that 1 cubic foot of water was evaporated per hour from 10 feet of generating surface exposed to heat—the initial temperature of the water being 100°.

OF THE SAFETY AND PROBABLE DURABILITY OF THE BOILER.

These important qualities appear to me to be attained by your apparatus in a degree far superior to those possessed by any other description of boiler which ever came under my notice.

Deterioration and insecurity occur in steam boilers from various causes, but, it may be said, principally from selenitous deposits on the parts exposed to heat; from the corrosive action of the fire, or its deposits on the exterior of the metal; and from the deficiency of water.

By your arrangement the small pipes alone are attacked by the fire, and the water within them not being evaporated, there can be nothing deposited by the water to impair their substance or their action as carriers of heat. So long as these pipes remain full, it strikes me that they must be almost indestructible. Supposing however the metal in course of time to become impaired, from some cause with which we are unacquainted, all that can occur is, that a pipe may burst and discharge its water; or, let supposition be pushed to the extreme, and let all the pipes be imagined to burst at the same instant, the effect will be the issue of a few gallons of water in a state of steam, which is harmless. And should the pipes, in consequence of such bursting, become red-hot, no personal mischief can arise, for there exists nothing in an empty pipe, however hot, to produce mischief.

With respect to the second cause of deterioration in common boilers, we know that soot and tar are condensed upon the surface of ordinary boilers by the abstraction of heat from the products of combustion; we know the diminished conducting power of metallic surfaces thus coated, and also the corrosive action of these deposits. Your pipes do not appear to attach any soot or tar to them, and the reason obviously is, that the water within them is too hot to condense these products. If there were any such coating upon them, it would appear at the point of issue from the pocket where the pipes are the coolest; but whilst burning coals, I could not perceive any such coating, though I frequently examined the pipes at the flue opening.

No deterioration from these causes can possibly affect the body of the boiler or recipient, it being altogether insulated from the fire and from the products of combustion: that vessel, therefore, cannot suffer decay of its exterior except from leakage. Thus, I conceive this second great source of expense, and one cause of danger, to be obviated in your boiler.

The third cause of deterioration, and frequently of imminent danger, whether produced by neglect or accident, viz. deficiency of water, is proved by direct experiments to have no existence in your boiler. Feeling, as I did, the most perfect confidence in the safety of the apparatus, I submitted it to the following fierce and conclusive tests:

EXPERIMENT I.

Having an intense fire of coke on the grate, the damper wide open, the boiler in its most active state of evaporation, and the steam at 41 lbs. per square inch, the safety valves just swimming, the blow-off cock was opened, and the water was discharged from the boiler to the level of the pocket in a minute. The cock was then shut.

In this state of things the bottom of the boiler was dry; the hot-water pipes within the boiler were also externally dry; but some evaporation continued from the water in the pocket. The first effects perceived were a diminished issue of steam through the safety valves, and a rapid increase of temperature shown by the thermometric steam guage on the boiler, which therefore no longer indicated true steam pressure. Steam was then blown off, by raising one of the safety valves, to prevent the thermometer from being broken, as its range extended only to 315°. The steam, in color, resembled that of high elastic force escaping into the atmosphere; yet it was much feebler in elasticity than its appearance indicated. The thermometer was thus brought down to 260°.

The valve was again closed, and the remainder of the water in the pocket was discharged through the blow-off cock. The thermometer again rose rapidly, and when it attained 308°, equivalent to a pressure of 59¼ lbs. per square inch above the atmosphere, the steam's elasticity, by estimation from raising the valve by hand, did not exceed 5 lbs. per square inch.

The thermometer would have been broken in another minute, as there was not sufficient steam to carry off the heat of the pipes by blowing it through the safety valve. Water at 54° was instantly injected into the boiler at the pocket end, pure steam was as instantly evolved, and mixing with the surcharged steam, lowered the thermometer. As the pumping continued and the water reached the pipes, the mercury in the thermometer descended, and again corresponded with the true steam pressure on the rising of the valves at 41 lbs. which took place almost instantly on ceasing to pump.

The boiler was now precisely in the same state as to contents of water and steam, heat of fire, &c. as at the commencement of the experiment. It had been kept entirely dry about ten minutes; the pumping in of the cold water occupied about three minutes.

EXPERIMENT II.

This experiment was undertaken with the view of observing the phenomena attendant on the gradual evaporation to dryness of the water in the boiler; the first experiment having shown the effect produced by the sudden evacuation of its contents. I wished also to ascertain with greater accuracy the fact that steam surcharged with heat suffers little, if any, increase of elastic force. I previously determined, by removing the weight from the lever, that the safety valve and lever together balanced steam at 3½ lbs. per square inch, equal to a temperature of 220°, and that the valve, without the lever, liberated steam at 1 lb. per square inch.

The fire being as in the first experiment, the damper open, and the feed stopped, the water was rapidly evaporated to the upper level of the pipes in the recipient. Pure steam appeared to issue till the pipes

were nearly if not quite uncovered; the thermometer then gradually rose, the steam passing off at the constant pressure of 3½ lbs. Evaporation now went on more slowly; the boiler became entirely dry, steam being only produced from the water in the pocket. It required about three quarters of an hour from the commencement to evaporate to the bottom of the pocket. Steam still issued through the valve, very transparent in color, sometimes almost invisible, and balancing the valve only without the lever. The discharge cock was opened: nothing issued but a small quantity of water condensed in the pipe, which was about eight yards in length, and exposed to the atmosphere. The little steam still produced arose from a small quantity of water below the discharge cock at the bottom of the pocket. The thermometer now indicated 250°—equivalent, with natural steam, to a pressure of about 15 lbs. per square inch; whereas the issuing steam, surcharged as it was with heat, scarcely equalled 1 lb. per square inch above atmospheric pressure.

The thermometer began to rise rapidly, and water at 54°, as in the first experiment, was quickly pumped into the boiler. The thermometer fell; the lever was let down upon the valve; a copious evolution of steam took place as the water gained the pipes; the weight was placed upon the lever; and the two valves presently rose accurately, as usual, at 41 lbs. per square inch, as if the ordinary process had been uninterrupted: the engine resumed its work, and no derangement of the apparatus, no injury, nor inconvenience of any kind had been sustained.

The entire experiment occupied about an hour; the boiler was dry during at least half an hour; and the fire was urged by the full force of the draught of the chimney.

During both these experiments the heated pipes took care of themselves, discharging a portion of their water through the valve provided for that purpose, as its dilatation and pressure increased.

As one of my objects in the second experiment was to observe tranquilly the indications of the thermometer, compared with the pressure of the escaping heat-surcharged steam throughout the process of working the boiler dry, and as the range of the thermometer was not great enough to secure it from breaking, if the pipes were heated to the same degree as in the first experiment, the steam was kept continually blowing, and the fire-door was occasionally opened when the water-pipe indicator marked excessive pressure and consequent temperature, towards the conclusion of the experiment; we had thereby the satisfaction of seeing that the admission of a current of air instantaneously lowered the heat of the pipes, as testified by the thermometer within the boiler, and by the water-pipe indicator without.

ON PRIMING.

EXPERIMENT III.

This experiment had reference to priming. I had not observed that any water was carried over by the steam into the engine, though, when suddenly started with its load on, the glass guage indicated commotion in the water of the recipient, from the sudden liberation of the steam. Nevertheless, so soon as the engine was in regular motion, the guage

showed the level of the water to be as before it was started. I desired, however, to ascertain if priming could be produced by the sudden disengagement of a greater quantity of steam from the boiler than the engine alone could carry off. For this purpose, with the fire in full activity, and steam at 41 lbs. pressure, a discharge-pipe on the top of the boiler, one of the safety valves and the engine valve were all simultaneously opened; the immediate effect was the carrying off of about an inch in depth of water, the guage exhibiting violent oscillations in the water. Subsidence of the water and uniformity of evaporation, however, took place almost instantly. A less amount of water was carried over with two pipes open, and still less with one; but some water always accompanied the steam if the safety valve were suddenly and fully opened, with steam in the boiler at a high pressure. No priming occurred when the valves rose only in obedience to the pressure, and of their own accord.

My opinion was that such would be the result of this experiment, and that much less water would be projected in yours than in ordinary boilers, which are known sometimes to discharge the whole of their contents by simply boiling over, by suddenly lifting the safety valves, or by what is termed *canting* their water into another boiler working alongside; thus becoming dry, and often ruined, if not burst or collapsed. This can only happen where the fire is applied to the bottom and sides of a vessel; but as your pipes have water below them, and as there is no heat acting on the bottom of the boiler, the sudden removal of pressure from the surface of the water cannot cause the water to quit the bottom by the rapid formation of steam at that part, as no steam is there formed. The two previous experiments also show that neither from the most sudden, nor from the most gradual discharge of all the water, can evil consequences ensue.

The following conclusions flow from these last experiments:

1. That your boiler may be blown off, and entirely emptied, without the slightest danger or inconvenience, when the fire is in full activity, and that in a few minutes an engine may be again at work. In practice it would be always wise to keep the fire-door open during the evacuation and refilling of the boiler.

2. That in the event of an engine-man neglecting to supply the boiler with water, or in the event of any derangement occurring to the feed apparatus, no harm can ensue; for both the quantity of steam produced, and its pressure, rapidly diminish when the water quits the pipes. An engine would stop for want of steam, and announce the fact of your boiler becoming dry, were it otherwise unobserved.

3. That no harm can ensue from suddenly injecting cold water into your boiler when empty, and an intense fire in action, as the heated pipes would discharge their water before it could attain a temperature capable of decomposing steam in the recipient.

4. That a vacuum cannot be produced within the boiler by the sudden injection of cold water by the ordinary feed pumps, when the fire is in action; for as the supply is sent through the pocket, the pipes evaporate fast enough to maintain a constant elasticity of steam above atmospheric pressure.

5. That all the expense and danger consequent to overheated, or dry

flues, in marine or other common boilers, are avoided by your arrangement; for, in your boiler, there are no flues nor extensive weak surfaces to be burnt, burst, or collapsed.

I have already stated the extent of mischief that can possibly arise on the rupture of your pipes, or on their becoming red-hot from being dry. I understand from the owners of the boiler, who have had it in work nine months, that the weight of the safety valve once came off the lever, and all or a great proportion of the water escaped from the pipes, but they were immediately injected full again by the pump fixed to the apparatus for that purpose, without any leak appearing or any harm being done. Since this occurrence, the valve was secured in such a manner as to prevent its repetition.

The steam recipient may be doubtless ruptured by an internal pressure exceeding its strength of resistance; and in this respect your boiler necessarily requires the observance of the same precautions in strength of structure, and in efficiency of safety valves as all other boilers. There is no motive for making your steam recipient for low-pressure engines less strong than that of the boiler on which I experimented, and which worked a non-condensing unexpansive engine commonly requiring steam at about 20 lbs. per square inch—the safety valves rising at 41 lbs.—and it was, I understood, proved by the maker in your presence at 100 lbs. per square inch by water pressure. The form and strength of the recipient can be adapted to the purpose required of it, and as you obtain an equal evaporative effect with much less bulk of material and weight of water than ordinary boilers, there exists no motive for constructing a weak vessel. It would be a great advantage to all engines, at whatever elasticity they may use their steam, to have boilers so secure that they need not part with the steam through safety valves, till it has attained a much higher than the working pressure. You had the opportunity during these experiments of being convinced of the fact that, though there is no gain, there is no loss in generating steam in the boiler at 40 lbs. when the engine only required it at 20 lbs. or 10 lbs. pressure, for the same load always required the same weight of water as steam, hour by hour, at whatever elasticity the steam existed within the boiler. This arises from the constituent property of steam, viz. that an equal quantity of heat exists in an equal weight of steam of all specific gravities; or if there be any difference, it is not discoverable in practice at those pressures.

OF THE GRATE AND FIRE INDICATOR.

It remains that I should report to you the result of my observations on the properties of your grate, which forms an important part of the invention.

The grate is in fact a portion of the heating apparatus, and absorbs caloric from the fire equally with every other part of the pipes. It is so much heat-absorbing surface added to the boiler. But it performs another valuable office; the pipes abstract the heat so rapidly from the fire, that the fused metallic or earthy portions of the combustible do not adhere to them. Consequently the scoriæ or *clinker*, as this refuse is commonly called, does not close the air spaces, and the poker is unnecessary for raising it up. Coke is known, from the greater intensity

U.S. GEOLOGICAL SURVEY
1887
LIBRARY

of its heat than coal, to be troublesome as a fuel for boilers, on account of its clinker adhering firmly to the fire bars. No such effect takes place on your grate; each piece of clinker remains as free upon the grate as a piece of cinder or ash. The cause of this is very obvious. Solid iron grate bars frequently become fused on their upper surface, and unite with the scoriæ of the fire; or the slag, in a state of fusion, runs between the bars. Hence their rapid destruction with intense fires, and hence the labor of clearing them. The solid bar has not sufficient conducting power to cool down the slag without itself being burnt. The circulation within your pipes converts them into such good conductors that the slag seems to be solidified before it reaches them. It appears generally to rest upon the ashes, and the ashes on the bars, for I observed ashes and pieces of cinders adhering to the clinker; but I have in no instance perceived an impression of the pipe on its under surface; nor, during the experiments, was there any occasion to use the poker or the pricker to facilitate the entrance of air to the fire. Thus, whatever falls into the ash-pit may be again thrown on the fire, till all the combustible matter of the fuel is consumed, which was my practice at the termination of each experiment.

The draught of the chimney being insufficient to create so rapid a combustion as was desirable for the purpose of testing the quality of the grate at the highest intensities of boiler fires, I resorted to a means of creating a blast which the apparatus attached to the boiler fortunately presented. The discharge pipe of the boiler entered the chimney and turned up again, so that by passing a current of high steam through it, the intensity of a locomotive fire seemed to be attained in the furnace. No slag, however, adhered to the bars, but remained as free as under the process of the slowest combustion. Nevertheless, the specimens you have of scoriæ produced from anthracite under this blast, give evidence of the fluidity to which its earthy or metallic ingredients were reduced in the fire.

These are practical proofs of the quality of your grate in neutralizing the inconvenience and expense arising from clinkering fuel; but the conducting power of these pipes full of water in circulation, is perhaps still better illustrated by pouring red-hot lead upon them. The lead is instantaneously solidified; whereas if it be poured upon an empty pipe, or a pipe filled with cold water, in which there is no circulation, the lead remains fluid for some time. The experiment requires that a small bath of clay be formed about the pipe to hold a cup full of molten lead.

The rapid absorption of heat by your boiler apparatus is thus very elegantly exemplified.

In this boiler the grate formed part and parcel of the apparatus; but it may be applied separately to boilers in common use with the same advantages as respects the non-adherence of clinker, and durability, with the addition of a certain quantity of evaporative surface.

The indicator, which exhibits the pressure within the hot-water pipes, would be an admirable tell-tale to the captain of a steamer (if fixed in his cabin) of the attention of the firemen to their duty, for this instrument marks the intensity of the fires relatively to the pressure of the steam within the recipient, and cannot be tampered with. It is also a perfect pyrometer for its practical object, and if the captain should observe a

sudden rise of the index, he would be quite certain that the water was getting below the pipes in the recipient—that the latter was foul, or filling with salt—that more heat was being generated than could be carried off, &c.; or, if he should see the index suddenly return back to zero, he would become aware of the fact, without inquiry, that the fire was extinguished—that the water had escaped from the pipes, or at all events that something extraordinary had happened. This instrument shows a fireman when to fire, or to regulate his damper, better than a steam guage can do. Firemen would soon become accustomed to its indications, and learn to diminish the production of steam by lowering the heat of their fires, instead of resorting to the wasteful practice of blowing off steam—a practice positively dangerous in boilers having a small capacity of steam chamber, and but little water above heated flues, or which, from their construction, or the quality of water employed, are subject to prime and boil over by a sudden diminution of steam-pressure. Safety valves cease to be instruments of security in many cases when suddenly raised; and in all cases it is much wiser that they should rise only in obedience to a determined pressure.

During the fortnight's attention which I have given to your boiler, and to the engine worked by it, no part of the apparatus got out of order, nor does it seem to me to be susceptible of derangement unless from wilfulness or extraordinary neglect; and I have stated to you my reasons—founded on experiments which no one would dare to perform on common boilers—for coming to the conclusion that, in the event of any such suppositious derangement, no mischief can ensue to persons in charge, nor to the apparatus itself.

It would appear from the foregoing that water, when confined in pipes, in passing from the temperature of the atmosphere to 212° exerts a great pressure; and when in this state has the power to receive heat from hot and impart it to cold substances, with much greater rapidity than can possibly be attained by any known means which are practically available.

We learn from Mr. A. S. Byrne, who is connected with the chemical manufacturing establishment of Messrs. Bacon, Petch & Co. New North Road, Haxton near London, that Mr. Perkins erected a boiler in their factory capable of working a 30-horse power engine. It is much smaller than the former boiler, performs the same duty without any increase in amount of fuel used, and has been six months in successful operation. See article in this number on Perkins's Steam-Gun.

For the American Repertory.

ON THE EFFECTS OF ARTS, TRADES, AND PROFESSIONS, AS WELL AS HABITS OF LIVING, ON HEALTH AND LONGEVITY.

BY CHARLES A. LEE, M. D. NEW-YORK.

No. I.

One of the distinguishing characteristics of our countrymen is the possession of a high inventive genius. In almost every department of art there are numerous ardent and successful cultivators. Competition excites to industry; emulation begets excellence; success insures reward; the government stretches forth her fostering arm; and private as well as public patronage stimulates to the attainment of superior skill and eminence. Previous to January, 1840, more than 11,500 patents had been issued from the United States Patent Office; a mere digest of which, just published, forms an octavo volume of 750 pages. During the year 1839, more than 800 applications for patents were made at the Patent Office, of which more than half were granted. At the last annual fair of the Mechanics' Institute in this city, premiums were awarded for specimens of manufactures in 115 different departments of art; and at the fair of the American Institute, a still larger variety of distinct branches of manufacturing skill was exhibited. If these results do not show that we are actually in advance of foreign nations, they certainly indicate a progress unequalled in the history of civilization. It is but sixty-four years since we first declared ourselves independent; previous to which time we were indebted to Great Britain for nearly all our manufactures. But should war now close our ports, and put an end to commercial exchanges, we should hardly experience the loss of a single article which we have hitherto procured from abroad. Already do our cotton fabrics compete with those of England in foreign markets; our locomotives are in demand on all the railroads of Europe; the civil engineering on our canals and other public works has been carried to so high a pitch of excellence, that deputations of scientific men have been sent out by several foreign governments

to survey and report on these improvements. In a few years we shall be independent of all other nations for our silks and woolens: even our sugar will be supplied to a great extent from the beet and maple; and possessing as we do nearly every climate within the broad range of our extended territory, we may if we choose, and we shall if it is our interest, raise and manufacture within ourselves nearly every article of use or luxury known to the wants or caprices of man.

What we call the arts, are merely the result of the application of the principles of science, and they have accordingly sprung from a knowledge of these principles and an acquaintance with the relations of cause and effect. And how has the development of these arts changed the aspect of our globe, given new direction to the industry, and added untold wealth to the resources of nations! Sixty years ago, and the composition of the air we breathe and the water we drink was unknown; the machinery that weaves our clothing had not been invented; steam had scarcely begun to perform its miracles; gas light had not exhibited its splendors; railroads were scarcely heard of; people were neither acquainted with the elements by which they were surrounded, nor knew how to convert them to their own purposes. Geology was then only another name for a system of absurd hypotheses; analytical chemistry had no existence; electro-galvanism had not yet revealed its wonders; experimental physiology was unknown; and phrenology or the doctrine of the nervous system had not dawned upon the world. Within the memory of man new arts have sprung up; new sciences been created; and innumerable practical inventions have given a new aspect to human society. Labor has been superseded; expense abridged; time saved; public comfort enhanced; national wealth increased; education promoted; and the welfare and happiness of man exalted.

But in the attainment of these important results, has there been no sacrifice? Have no physical or moral evils attended the various processes of manufacturing art and mechanic labor? These are important questions; for if, on examination, we should find that they have been attained at the expense of health and life, we might well pause and ask, whether it is

right to purchase them at such a cost. The pursuits of commerce too, we know, are in a high degree dangerous, and multitudes of adventurous seamen annually perish in procuring for us the productions of other lands. So also in subduing new and uncultivated regions, the agricultural laborer often encounters numerous hardships and perils; he often suffers the loss of health, and perhaps perishes of fever, the prevailing disease of such countries. In both cases, the dangers are to some extent unavoidable; they are the price which the sailor and the farmer are willing to pay for future ease and competence. But many of these evils might be escaped, and most might be alleviated, with proper knowledge and caution. The dangers of the sea have been more than quadrupled through the agency of intoxicating drinks; and thousands annually fell victims to unwholesome food, bad air, and filthy habits, before Cook and other commanders demonstrated the conservative influence of ventilation, cleanliness, and wholesome diet. The scurvy, at a period not remote, swept away a great portion of the crews of whole fleets; and the ship-fever was scarcely less fatal; but both of these are now rarely to be met with, and never where proper precautionary measures are adopted. So also in the manufacturing and mechanic arts, the health of artificers has suffered, and life itself been sacrificed, through ignorance or neglect of a few simple rules, or want of acquaintance with a few principles of general application. All other science has been deemed important but the science of life; all other knowledge valuable but that relating to health. Physiology, in which every individual is interested, instead of being generally studied, and becoming the science of the multitude, has been considered as the exclusive domain of the medical man; and the consequence has been, in innumerable instances, the loss of health and even of life. Operatives suffer not only from too long and close confinement to their labors, but from a confined and impure atmosphere, subjected to dust, odor or gaseous exhalations, to wet and vapor, to sudden changes of temperature; from the cramped and unnatural position in which their manipulations are carried on; from intemperance, unhealthy diet, mental anxiety, and other causes. Various accidents are incidental to

some manufacturing processes, and great caution is necessary to guard against injuries from machinery; and after all, many fall victims to this cause. In some instances, the *skin* is constantly exposed to injurious agents, as among *potters*, *grocers*, *hatters*, *silverers of mirrors*, *&c.*; in others, the *lungs* suffer most, from exposure to the noxious agent, as among *millers*, *malsters*, *tobacconists*, *paper-makers*, *feather-dressers*, *weavers*, *hatters* employed in the *bowing* department, *workers in flax*, *cabinet-makers*, *masons*, *ware and file-grinders*, *colliers*, *miners*, *machinists*; *workers in wood*, *ivory or metal*; *brass-founders*, *painters*, *plumbers*, *manufacturers of white lead*, *braziers*, *tin-plate workers*, *coppersmiths*, *gas-makers*, *rectifiers and distillers*, *paper-stainers*, *button-makers*, *looking-glass makers*, *jewelers*, *chemists and druggists*, *bleachers*, and many others. Many suffer from the cramped position in which their work is carried on; as *tailors*, *shoemakers* and *engravers*; others from the heat to which they are exposed, as *glass-workers*, *iron* and *brass founders*, *smiths*, *sugar-refiners*, *cooks* and *confectioners*, *bakers*, and those engaged in some of the departments of *cloth manufacture*.

The importance of our subject will appear still more obvious, when we consider that nearly our whole population belong to the working class; for professional men—the lawyer, the physician, the clergyman—are no less working men than the artisan and the manufacturer; and there is, happily, no class among us exempt from labor but the very young, the aged, and the invalid. We have no aristocracy of wealth or honor. No man, however high his station, or distinguished his reputation, can say to the sons of the poor mechanic, "I am what you can never be." Although manufactures have flourished to a considerable extent in our country, yet we cannot, like England, be called a manufacturing nation. Of none of our children can it be said, as has been said of the latter, "born to labor, they are doomed to the factory almost before they are begotten, and the squalid urchin picking flax or cotton is the type of the future man." Nor of our agriculturists, that "they are represented by the gaunt yet abject being whom the open day sees crawling from the plough-tail to the poor-house."* A degree of comparative

* Med. Chir. Review, Vol. XVIII, p. 101.

comfort and happiness is found among every class of our citizens; but it does not hence follow that there are no evils to be removed, and no abuses corrected. We hope to be able to make it appear, in the course of these essays, that with the same and even greater economical results, the health, the physical and moral well-being of all classes of our population can be vastly enhanced; that from either ignorance or inattention, the effects of arts, trades and occupations upon the health and longevity of our citizens have been more injurious and unpropitious than the necessity of the case requires; and consequently that their happiness and prosperity are susceptible of improvement. In doing this, a variety of topics will necessarily come under consideration besides those which we have pointed out; such as habits of living, including dress, food and drinks, cleanliness, ventilation, &c.; education, amusements and morals; in short, every thing which has a bearing upon the physical or moral well-being of the laboring classes. We shall regard man as a compound being, consisting of an animal, moral and intellectual nature, each of which is adapted and adjusted to the other in such a manner as to produce, under proper discipline and training, a harmonious result. As an animal, we shall treat of him as consisting of bones, muscles, blood-vessels and nerves—organs of nutrition, secretion, respiration and intellect. We shall assume it as granted, that the perfect development of his physical organization requires that he should originate from healthy parents; that he should have a due supply of proper aliment; pure air and water, light and warmth, and that he should exercise his organs within normal limits. The question what is the proper food of man, must be determined by experience, observation and extensive induction; a few isolated cases, and those perhaps of invalids, not being sufficient to lead us to a safe conclusion. We may as well remark here, that we believe no general rules can be laid down applicable to all, or which will apply to the inhabitants of different climates. Those, for example, who live in the colder regions of the north, require chiefly strong animal food, in large quantities, for the maintenance of the usual degree of animal heat; in temperate latitudes, a mixture of animal and vegetable food is demanded, and is

found most conducive to health; while in tropical countries an almost exclusively vegetable diet is not only most agreeable, but is by far the most salutary. When we say that pure air is essential to health, we mean, that it should contain not only the usual proportions of oxygen and nitrogen, but that it should be free from those adventitious mixtures foreign to it; such as marsh-miasmata, deleterious gases, floating particles of matter given off by various materials, while undergoing the manipulations of the artificer. The same remark may be applied to water. This is generally unwholesome in proportion to the quantity of foreign matter contained in it, whether, animal, vegetable or mineral; hence the insalubrity of such as is obtained from wells in large cities, or from stagnant pools and marshes.* That man requires for the full development of his physical powers the influence of light and heat, is too well known and too generally admitted to need remark. We see it exemplified in the diminutive stature of the Greenlander and the dwellers beneath the pole; in the pale, weak and emaciated condition of those shut up for a long time in bastiles and prisons. We shall assume also that the full and complete development of our physical capacities requires that our organs should be exercised. We may enjoy all the above conditions, and yet from inactivity our bodies may possess neither beauty, health, nor vigor. The violation of such a fundamental law as exercise, we shall find, always carries its punishment along with it; and however it may have been in the primeval state of man, yet now we cannot but see and admire the wisdom and the goodness of that divine injunction, "in the sweat of thy brow shalt thou eat bread." We shall not only assume these things to be proved, but we shall consider it established that the moral and intellectual faculties have material organs assigned them in the brain, which serve to them as instruments by which they work out their grand results. We believe that a sufficiently extensive induction of facts has proved that the

---

* It has lately been proved that much of the Albany beer has been manufactured from such water for years past. This accounts in part for its extremely unhealthy qualities. *See Report of Beer Trial, J. Taylor* vs. *E. C. Delavan,* (verdict in favor of the latter.)

anterior portion of the cerebral mass is assigned to the intellectual and rational faculties; the superior portion, to the moral sentiments; and the posterior and inferior portion, to the animal propensities, common to man and the brute. In order to health and the possession of what is called a well-balanced mind, we hold, with the phrenologist, that these must all act in harmony; that the preponderance has been given to the moral and intellectual faculties, in order to control our inferior appetites, to choose between right and wrong, and guide our steps through the dangers which surround us. Metaphysicians have spent much unnecessary labor in attempting to prove the freedom of the will and the liberty of choice; but our own consciousness settles this question far more conclusively and satisfactorily than all the reasonings and speculations of a Locke, a Reid, or an Edwards. We feel and know that we are free agents, that our faculties are all good, created for our enjoyment, and that it is only through their abuse that they become instruments of evil and of suffering. We feel, that the exercise of these various faculties, in obedience to the organic and physical laws of our nature, which harmonize with the precepts of Christianity, confer moral and intellectual pleasure, and are no less conscious that they are strengthened and invigorated by such exercise; that in order to health and happiness, they must act harmoniously, each in its proper sphere, all in their proper season.

With these grand landmarks or principles as our starting point, as conceded to be essential to the physical and moral well-being of the whole human family, we shall in the next number of the Journal enter more immediately upon the subject before us.

Report of the Committee on Arts and Sciences of the Mechanics' Institute, upon THOMAS COOPER'S *Anthracite Furnace.*

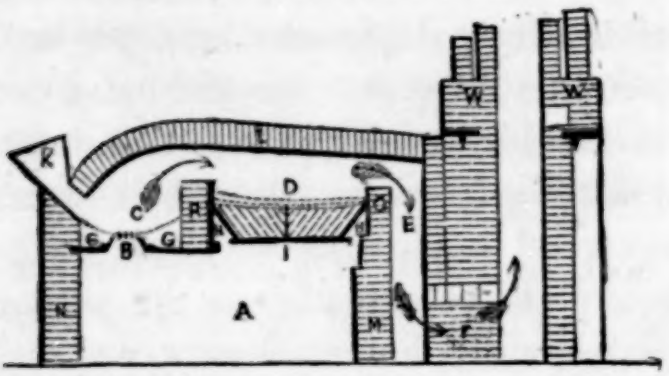
The Committee beg leave to report, that this invention is a reverberatory furnace, of such improved construction and arrangement as adapt it, among other uses set forth by the inventor, to the 'puddling' and 'scrapping' of iron with anthracite coal. The great benefit conferred upon the manufacturing

interest of the country, by an attainment of this result in a manner that renders the discovery practically useful, will be apparent from the slightest reflection.

A highly favorable account of the operation of this furnace was rendered to the Committee by a deputation from their body who visited the works of Mr. Cooper erected in 33d street, on this island. The furnace has been used about eight months for heating scrap and billet iron; this being the branch of business to which the inventor almost exclusively turns his attention. Its applicability for a puddling furnace, however, was tested in the early part of that period, by the production of a quantity of puddled iron of an excellent quality, some specimens of which were deposited and yet remain in the Library of the Institute for inspection. In point of economy, the Anthracite Furnace possesses decided advantages over furnaces heated with bituminous coal, apart from the saving that arises from the use of a cheaper and more compact fuel: the waste per cent of iron by oxidation is much less than in the ordinary reverberatory furnace.

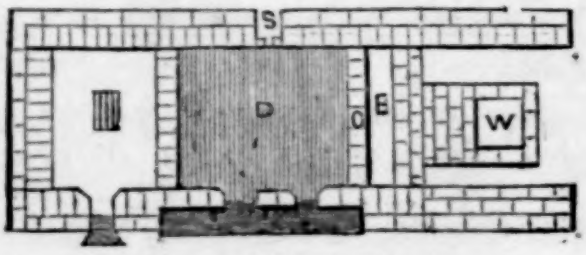
DESCRIPTION AND PLANS.

No. 1.



No. 1 is a vertical section of a single furnace, flue, and chimney stack.

No. 2.

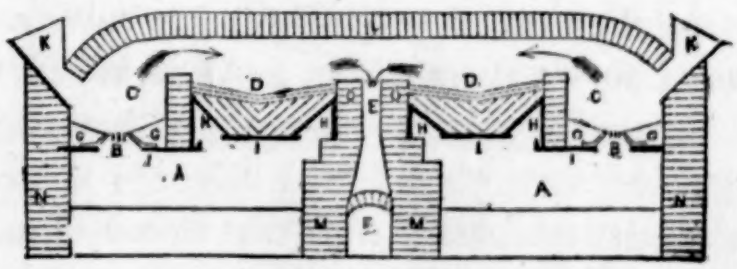


No. 2 is a horizontal plan of a single furnace.

C, the coal chamber, which rests upon cast-iron bridges extending from the front to the rear wall, and entering each to the depth of four or six inches. In the bottom of this chamber is

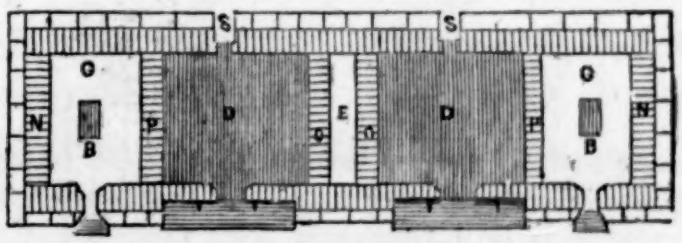
placed a small grate B, surrounded by a hearth or dead work, made of ashes or other material, that will protect the side walls from the intense heat generated in the centre of the mass of coal, or that part immediately over the grate. D, the puddling or heating chamber, supported upon bridges in like manner with the coal chamber. E, the flue, descending vertically from the heating chamber, and passing through the horizontal part F, into the chimney stack W, as indicated by arrows. A, the ash-pit, which serves also to receive and heat the air-blast. K, a hopper for feeding the furnace with coal. S, an opening in the rear wall, through which the slag or cinder flows.

No. 3.



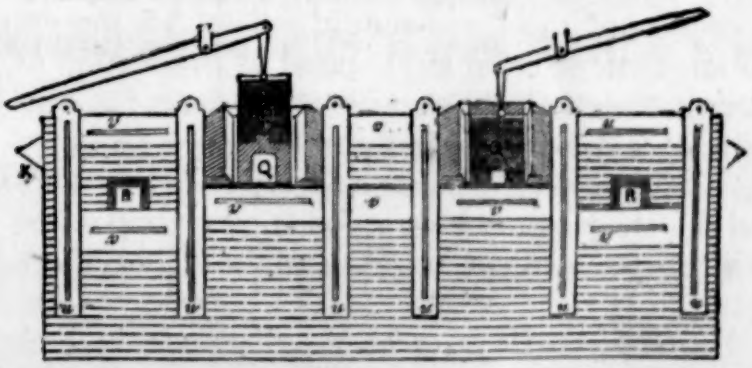
No. 3 is a vertical section of a double furnace, which is the arrangement preferred by the inventor, and is identical with that now in operation at his works.

No. 4.



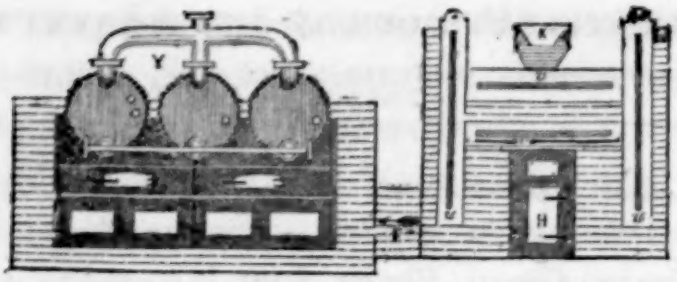
No. 4 is a horizontal view of a double furnace; like parts in all these plans being designated by the same letters of reference.

No. 5.



No. 5 is a front elevation of a double furnace, showing the doors Q opening to the heating chambers, the doors R for regulating the fires in the coal chambers, and the clamps and binders *u v* for bracing the walls in a proper manner.

No. 6.



No. 6 is an end view of a furnace connected with a set of boilers Y, in which steam may be generated with the waste heat of the furnace. H is a door opening into the ash-pit: the upper part of this door is so arranged as to supply the coal chamber with air when the blower is not in operation.

All of which is respectfully submitted.

W. A. COX, *Chairman.*

MECHANICS' VADE MECUM.

No. III.

The herewith given Table, showing the strength of oak and fir columns when subjected to a crushing force, and the explanatory remarks accompanying it, are taken from "Turnbull on the Strength of Timber."

The numbers in the following table have been obtained at the expense of much labor. Great attention has been paid to the accuracy of the results, and this will insure a very near approximation to the real strength of the columns in question; the estimate is that which considers the direction of the straining force to coincide with the surface of the column, which limit has been taken to secure sufficient strength; for if the direction of the force should fall within the column nearer to the axis, the strength will be augmented in proportion as it approaches the centre; therefore, columns constructed from the numbers given in the table will always be sufficiently strong.

The table is adapted for oak and fir only, but as these are the only timbers used in supporting heavy loads, its application is sufficiently extensive; it may be applied to other timbers, but the results will not be so accurate.

To use this Table.—Enter with the diameter in inches at the top, and the length in feet in the left-hand margin; then in the body of the table, under the diameter and opposite the length, is the load in cwts. that the column will support with safety.

To find the diameter.—Enter with the given length in the margin, and run the eye across the page till the weight be found; then at the top of the column is the diameter in inches.

THE STRENGTH OF OAK AND FIR COLUMNS.

Len. in feet.	DIAMETER IN INCHES.							
	1	2	3	4	5	6	7	8
	Cwt.	Cwt.	Cwt.	Cwt	Cwt.	Cwt.	Cwt.	Cwt.
1	19.60	21.38	48.94	87.53	137.15	197.80	269.46	352.17
2	14.70	19.60	47.01	85.54	135.13	195.76	267.43	350.12
3	10.38	17.21	44.11	82.42	131.90	192.47	264.09	346.76
4	7.35	14.70	40.60	78.41	127.63	188.04	259.56	342.16
5	5.34	12.38	36.83	73.80	122.52	182.63	253.96	336.43
6	4.01	10.38	33.08	68.85	116.81	176.43	247.43	329.68
7	3.09	8.71	29.52	63.80	110.71	169.62	240.14	322.04
8	2.45	7.35	26.27	58.31	104.42	162.39	232.24	313.65
9	1.98	6.24	23.35	54.03	98.10	154.91	223.90	304.66
10	1.63	5.35	20.77	49.52	91.89	147.33	215.25	295.20
11	.....	4.61	18.51	45.35	85.88	139.76	206.44	285.41
12	.....	4.01	16.54	41.51	80.14	132.32	198.40	275.40
13	.....	3.51	14.82	38.02	74.71	125.08	188.77	265.29
14	.....	3.09	13.33	34.85	69.61	118.11	180.10	255.17
15	.....	2.75	12.03	31.99	64.86	111.43	171.64	245.14
16	.....	2.45	10.89	29.41	60.45	105.08	163.43	235.24
17	.....	2.20	9.89	27.08	56.37	99.07	155.51	225.55
18	.....	1.98	9.02	24.98	52.61	93.40	147.91	216.10
19	.....	1.79	8.25	23.09	49.14	88.08	140.64	206.95
20	.....	1.63	7.57	21.38	45.95	83.09	133.71	198.10
21	.....	1.49	6.96	19.84	43.01	78.41	127.13	189.57
22	.....	1.37	6.43	18.45	40.30	74.05	120.89	181.39
23	.....	1.25	5.94	17.19	37.81	69.97	114.98	173.55
24	.....	1.16	5.51	16.04	35.53	66.16	109.40	166.05
25	.....	1.07	5.12	15.00	33.41	62.61	104.13	158.90
26	.....	1.00	4.77	14.04	31.47	59.30	99.16	152.07
27	.....	.....	4.46	13.18	29.67	56.21	94.47	145.58
28	.....	.....	4.17	12.38	28.01	53.32	90.05	139.40
29	.....	.....	3.91	11.65	26.48	50.63	85.89	133.53
30	.....	.....	3.67	10.98	25.06	48.12	81.97	127.95
31	.....	.....	3.45	10.37	23.74	45.77	78.27	122.65
32	.....	.....	3.26	9.80	22.52	43.57	74.79	117.62
33	.....	.....	3.07	9.28	21.39	41.51	71.50	112.84
34	.....	.....	2.91	8.79	20.33	39.59	68.41	108.31
35	.....	.....	2.75	8.34	19.34	37.78	65.49	104.01
36	.....	.....	2.61	7.93	18.43	36.09	62.74	99.92
37	.....	.....	2.48	7.54	17.57	34.50	60.14	96.05
38	.....	.....	2.35	7.18	16.77	33.00	57.68	92.36
39	.....	.....	2.24	6.85	16.02	31.60	55.36	88.86
40	.....	.....	2.13	6.53	15.31	30.28	53.16	85.54
41	.....	.....	2.03	6.24	14.66	29.03	51.09	82.38
42	.....	.....	1.94	5.97	14.04	27.86	49.12	79.37
43	.....	.....	1.86	5.71	13.46	26.75	47.26	76.52
44	.....	.....	1.78	5.47	12.91	25.70	45.49	73.80
45	.....	.....	1.70	5.24	12.39	24.71	43.82	71.21
46	.....	.....	1.63	5.03	11.90	23.78	42.23	68.74
47	.....	.....	1.56	4.83	11.44	22.89	40.72	66.39
48	.....	.....	1.50	4.64	11.01	22.05	39.28	64.15
49	.....	.....	1.44	4.46	10.60	21.26	37.92	62.02
50	.....	.....	1.39	4.29	10.21	20.50	36.62	59.98

THE STRENGTH OF OAK AND FIR COLUMNS.

Len. in feet.	DIAMETER IN INCHES.							
	9	10	11	12	13	14	15	16
	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.
1	445.90	550.65	666.43	793.24	931.07	1079.9	1239.8	1410.7
2	443.85	548.60	664.38	791.18	929.01	1077.9	1237.8	1408.7
3	440.47	545.21	660.98	787.77	925.60	1074.3	1234.3	1405.3
4	435.83	540.53	656.28	783.05	920.86	1069.7	1229.6	1400.5
5	430.00	534.63	650.33	777.06	914.84	1063.7	1223.5	1394.4
6	423.08	527.60	643.20	769.87	907.68	1056.4	1216.2	1387.0
7	415.19	519.52	634.98	761.54	899.17	1047.9	1207.6	1378.5
8	406.45	510.50	625.75	752.04	889.65	1038.3	1197.9	1368.7
9	396.97	500.65	615.61	741.77	879.09	1027.8	1187.1	1357.7
10	386.88	490.08	604.66	730.51	867.59	1015.8	1175.2	1345.7
11	376.32	478.91	593.00	718.46	855.22	1003.2	1162.4	1332.7
12	365.39	467.24	580.73	705.71	842.07	989.73	1148.6	1318.7
13	354.21	455.18	567.97	692.36	828.23	975.49	1134.0	1303.9
14	342.88	442.85	554.79	678.49	813.79	960.55	1118.7	1288.1
15	331.49	430.31	541.30	664.20	798.82	945.02	1102.7	1271.7
16	320.12	417.68	527.60	649.58	783.42	928.96	1086.1	1254.6
17	308.85	405.03	513.74	634.70	767.67	912.45	1068.9	1236.9
18	290.95	392.41	499.83	619.65	751.64	895.57	1051.3	1218.6
19	286.81	379.91	485.91	604.50	735.40	878.39	1033.3	1199.9
20	276.13	367.56	472.06	589.31	719.03	860.99	1015.0	1180.8
21	265.74	355.42	458.32	574.14	702.59	843.42	996.40	1161.4
22	255.64	343.51	444.75	559.05	686.13	825.74	977.64	1141.6
23	240.27	331.88	431.38	544.08	669.72	808.02	958.75	1121.7
24	236.43	320.55	418.25	529.28	653.39	790 31	939.78	1101.6
25	227.33	309.52	405.38	514.69	637.20	772.65	920.79	1081.4
26	218.57	298.83	392.81	500.33	621.17	755.09	901.83	1061.2
27	210.16	288.41	380.54	486.23	605.35	737.67	882.93	1040.9
28	202.09	278.45	368.59	472.42	589.77	720.42	864.13	1020.7
29	194.35	268.78	356.98	458.91	574.44	703.37	845.48	1000.5
30	186.94	259.45	345.70	445.71	559.39	686.56	827.01	980.53
31	179.86	250.47	334.77	432.85	544.64	670.00	808.74	960.65
32	173.08	241.82	324.18	420.32	530.20	653.71	790.69	940.95
33	166.60	233.50	313.94	417.63	516.08	637.72	772.11	921.46
34	160.41	225.50	304.04	396.24	502.29	622.03	755.39	902.19
35	154.51	217.81	294.47	384.77	488.84	606.67	738.16	883.17
36	148.86	210.44	285.24	373.61	475.73	591.63	721.23	864.42
37	143.47	203.35	276.33	362.79	462.97	576.92	704.61	845.95
38	138.33	196.56	267.74	352.31	450.55	562.56	688.32	827.78
39	133.42	190.04	259.45	342.16	438.48	548.53	672.36	809.92
40	128.73	183.78	251.47	332.34	426.74	554.85	656.74	792.38
41	124.25	177.78	243.78	322.84	415.35	521.52	641.46	775.17
42	119.98	172.02	236.37	313.65	404.28	508.53	626.52	758.29
43	115.89	166.50	229.24	304.77	393.55	495.88	611.93	741.75
44	111.99	161.21	222.37	296.18	383.13	481.35	597.68	725.56
45	108.26	156.11	215.76	287.88	373.04	471.59	583.77	709.70
46	104.70	151.26	209.40	279.87	363.25	459.94	570.20	694.19
47	101.29	146.58	203.27	272.12	353.76	448.62	556.98	679.03
48	98.03	142.10	197.36	264.64	344.57	437.61	544.08	664.21
49	94.91	137.79	191.68	257.42	335.48	426.91	531.52	649.72
50	91.93	133.66	186.21	250.44	327.04	416.52	519.28	635.58

THE STRENGTH OF OAK AND FIR COLUMNS.

Len. in feet.	DIAMETER IN INCHES.							
	17	18	19	20	21	22	23	24
	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.
1	1592.7	1785.7	1989.7	2204.7	2430.7	2667.8	2915.9	3175.0
2	1590.6	1783.6	1987.6	2202.6	2428.6	2665.1	2913.8	3173.0
3	1587.2	1780.2	1984.2	2199.2	2425.2	2662.3	2910.4	3169.5
4	1582.4	1775.4	1979.4	2194.4	2420.4	2657.5	2905.6	3164.7
5	1576.3	1769.3	1973.3	2188.3	2414.3	2651.4	2899.5	3158.6
6	1568.9	1761.9	1965.8	2180.8	2406.8	2643.9	2892.0	3151.1
7	1560.3	1753.2	1956.7	2172.1	2398.0	2635.2	2883.2	3142.3
8	1550.5	1743.3	1947.2	2162.1	2388.0	2625.1	2873.1	3132.2
9	1539.4	1732.2	1936.0	2150.9	2376.8	2613.8	2861.8	3120.9
10	1527.3	1720.0	1923.9	2138.5	2364.3	2601.3	2849.3	3108.3
11	1514.1	1706.7	1910.3	2125.0	2350.8	2587.6	2835.5	3094.5
12	1499.9	1692.3	1895.8	2110.4	2336.0	2572.8	2820.6	3079.5
13	1484.8	1677.0	1880.3	2094.8	2320.3	2556.9	2804.6	3063.4
14	1468.9	1660.8	1863.9	2078.1	2303.4	2539.9	2787.5	3046.1
15	1452.1	1643.7	1846.5	2060.5	2285.6	2521.9	2769.4	3027.9
16	1434.5	1625.8	1828.3	2042.0	2266.9	2503.0	2750.2	3008.6
17	1416.3	1607.2	1809.3	2022.7	2247.9	2483.2	2730.2	2988.3
18	1397.5	1587.9	1789.6	2002.6	2226.9	2462.4	2709.2	2967.1
19	1378.2	1568.0	1769.2	1981.8	2205.7	2440.9	2687.4	2945.0
20	1358.4	1547.5	1748.2	1960.3	2183.8	2418.6	2664.7	2922.1
21	1338.1	1526.6	1726.7	1938.3	2161.2	2395.6	2641.3	2898.2
22	1317.6	1505.3	1704.7	1915.6	2138.1	2372.0	2617.3	2873.9
23	1296.7	1483.6	1682.2	1892.5	2114.3	2347.7	2592.5	2848.7
24	1275.6	1461.6	1659.4	1868.9	2090.1	2322.9	2567.2	2822.9
25	1254.3	1439.3	1636.2	1845.0	2065.5	2297.6	2541.3	2796.4
26	1232.9	1416.8	1612.8	1820.7	2040.4	2271.9	2514.9	2769.4
27	1211.4	1394.2	1589.2	1796.2	2015.0	2245.7	2488.0	2741.9
28	1189.9	1371.5	1565.4	1771.4	1989.3	2219.2	2461.0	2714.0
29	1168.4	1348.7	1541.5	1746.4	1963.1	2192.3	2433.1	2685.6
30	1146.9	1326.0	1517.5	1721.3	1937.2	2165.2	2405.1	2656.8
31	1125.5	1303.2	1493.4	1696.0	1910.9	2137.9	2376.9	2627.7
32	1104.3	1280.5	1469.4	1670.7	1884.4	2110.4	2348.4	2598.3
33	1083.2	1257.9	1445.3	1645.4	1857.9	2082.7	2319.7	2568.7
34	1062.2	1235.4	1421.4	1620.1	1831.3	2055.0	2290.8	2538.8
35	1041.5	1213.1	1397.5	1594.8	1804.7	2027.2	2261.9	2508.8
36	1021.0	1190.9	1373.8	1569.7	1778.2	1999.3	2232.8	2478.6
37	1000.8	1168.9	1350.3	1544.6	1751.7	1971.5	2203.7	2448.3
38	980.80	1147.2	1326.9	1519.6	1725.2	1943.6	2174.6	2418.0
39	961.10	1125.8	1303.7	1494.8	1698.9	1915.9	2145.5	2387.6
40	941.69	1104.5	1280.8	1470.2	1672.8	1888.2	2116.4	2357.2
41	922.59	1083.6	1258.1	1445.8	1646.7	1860.7	2087.4	2326.9
42	903.80	1062.9	1235.6	1421.7	1620.9	1833.3	2058.5	2296.6
43	885.34	1042.6	1213.5	1397.7	1595.3	1806.0	2029.8	2266.3
44	867.20	1022.6	1191.6	1374.1	1569.9	1779.0	2001.1	2236.2
45	849.41	1002.9	1170.0	1350.7	1544.8	1748.1	1972.7	2206.2
46	831.95	983.48	1148.7	1327.5	1519.9	1725.5	1944.4	2176.3
47	814.84	964.43	1127.7	1304.7	1495.2	1699.1	1916.3	2146.6
48	798.07	945.71	1107.1	1282.2	1470.9	1673.0	1885.5	2117.1
49	781.64	927.34	1086.8	1260.0	1446.8	1647.1	1860.8	2087.8
50	765.56	909.31	1066.8	1238.1	1423.0	1621.5	1833.5	2058.8

NOTICES OF NEW PUBLICATIONS.

The Elements of Geology for popular use, containing a Description of the Geological Formations and Mineral Resources of the United States. By C. A. Lee, *M. D.* New-York: Published by Harper & Brothers. 1840.

A work of this description has been much required, and will doubtless meet with extensive sale. Most publications on this subject are too expensive for a wide circulation, and consequently but little is known even of the geology of our own country. Dr. Lee has collated all the important facts relative to the mineral resources of the United States; and with the assistance of the various state reports of surveys lately made, has rendered his work very complete. From the late developments of our inexhaustible mineral treasures, the science of geology is likely to claim a high rank, and to assume an importance commensurate with its true value. We shall in a future number make some extracts from the work, that will place in a concise form before the reader a mass of information relating to the coal and iron regions of our country—the productions that make up so large a portion of her natural wealth.

The Farmer's Instructor. By J. Buel, *Esq. In two Volumes.* Published by Harper & Brothers.

This work is a compilation of essays and papers upon the management of the farm and garden, interspersed with hints upon domestic economy, morals, and habits of living; selected from the Cultivator, a journal for some years conducted by Judge Buel. To those who are familiar with the high standing which that work obtained among the many magazines devoted to agriculture that have in this country sprung into existence since farming began to be with us considered a science, no further recommendation of the Instructor is necessary. To the uninformed in this matter we may add, that in no one of his numerous pursuits in life were the capacious mind and philanthropy of Judge Buel more conspicuous than in his conduct of the Cultivator.

The American Railroad Journal; a semi-monthly publication, by Messrs. Schaeffer and Hedge of this city, devoted principally to recording all that is valuable in the progress of railways here and in Europe. It also contains much that is interesting in science and mechanics generally.

PROGRESS OF THE MECHANIC ARTS.

Directions for correcting the Compass in Iron-built Ships; with extracts from a Letter to the Editor of the United Service Journal. *By* G. B. AIRY, *Astronomer Royal.*

I will now advert to the registering of the magnetic state of the ship. The construction of iron ships for sea voyages is a thing of late date; the accurate knowledge of their magnetical properties is not yet two years old. Yet property and lives to a great amount are already trusted, or will shortly be trusted, to these vessels; and their safety will depend in a very great measure on the continued accuracy of the magnetic correction. Reflecting on these circumstances, it has from the first appeared to me important that immediate steps should be taken for establishing on a firm basis our knowledge of the magnetical properties of iron ships. With regard to their properties at the time of experimenting, the problem is already solved; but with regard to the change which those properties may in time undergo, we have at present no knowledge whatever. The necessity for caution in this our ignorance is rendered still more striking from the circumstance that nearly the whole of the disturbing force in iron ships is one which a few years ago was scarcely recognized as existing in malleable iron, viz. permanent magnetism. It was first suggested by Com. Johnson, from observations of the disturbance of external magnets by the Garry Owen, not (as I think) from the disturbance of the compasses on board, that iron ships possessed independent magnetic power. My experiments on the compasses of the Rainbow not only confirmed this suggestion, but also gave the means of measuring the force; and it was found that this hitherto neglected force was twenty times as great as that which had been supposed to be the only one. The examination of every iron ship of which the particulars have yet reached me has fully supported this statement.

Now, the only way of ascertaining whether these unexpected properties of iron ships do or do not change with time, is to register their magnetic state at present, and to compare that state with the state ascertained by examination at future times. For this purpose, I have requested the gentlemen with whom I have corresponded on the subject of correcting the compass, to make such examination as is necessary for register of the magnetic state, in all cases in which it is probable that the same ship can be examined again. And I take this opportunity publicly to call the attention of persons interested in iron ships to the importance of this examination. I am well aware that a ship-owner thinks with impatience of the detention of his ship for six or eight days for a purpose of no immediate utility; yet I am confident that, as a ship-owner, he is well consulting his own interest by putting up with this delay, and with the small additional expense which it will cause to him.

It may be desirable that the magnetic register of each ship should be accompanied with a plan of the ship, (sufficient to show the general arrangement of the masses of iron) and with a description of the general quality of the iron, method of uniting the plates, &c. as well as with

notices of the position of the ship when building. I speak of the possible advantage of collecting these statements solely with reference to the acquiring a knowledge of the dependence of the magnetic forces upon the construction of the ship; but it is evident that such a collection would also be useful for other important objects.

I subjoin the directions for correcting the compass in iron ships, remarking, that the quality of the magnets used is of the very highest importance for the permanency of the correction.

DIRECTIONS FOR CORRECTING THE COMPASS IN IRON-BUILT SHIPS.

1. It is recommended that no step be taken in correcting the compasses, until the binnacles or other supports of the compasses have been constructed, but not fixed, and the compasses which are to be used in the ship have been procured. In this way only, in general, can the true elevation of the compass above deck, or its true distance from the deck or ceiling of the cabin be ascertained, the accurate knowledge of which is of great importance in the trials for correction.

2. The compasses may be placed in any part of the deck or cabins, and at any height that the captain may choose to adopt. But it must carefully be borne in mind, that the correction applies only to those places, and that, when the correction is completed, not the smallest alteration in the position of the compasses can be afterwards permitted.

3. If the ship's compasses are very delicate, the binnacles, &c. may be fixed, and the correction may be made with the ship's compasses in their places; in this way some trouble will be avoided. But in general, it will be better that the operator should provide himself with compasses of extreme delicacy, one to be used in the place of each of the ship's compasses.

4. The operator must also be provided with an azimuth compass of great delicacy. to be used on shore.

5. The ship must be placed in a floating dock or basin, where there are conveniences for mooring her firmly in any position. It will be necessary to have two hawsers attached to her bows, and two hawsers to her quarters.

6. When the captain has determined on the position in which each compass shall be placed, a plumb-line must be dropped from the place of the centre of the needle upon the deck, (or if in a cabin, the perpendicular may be carried upwards to the ceiling,) and through the point thus found upon the deck or ceiling, two chalk-lines must be drawn upon the deck or ceiling, one exactly parallel to the ship's keel, (or fore and aft)—the other exactly transverse to the former (or athwart-ships.) It will always be advisable, when the lines are traced upon a deck, to make corresponding lines on the ceiling below the deck-timbers, as the ceiling will generally be a more secure and commodious place for the attachment of the correcting magnets.

7. For each compass, the operator must be provided with two powerful magnets. each securely packed with tallow in a slender wooden box. In some instances, magnets of 14 inches in length have been used; but I recommend that in all cases magnets of 2 feet in length, or even larger, be employed. It will be found that the large and powerful magnets can be fixed more conveniently and in less exposed situations than the smaller: moreover, the effect of a small disturbance in the place of the compass is considerably diminished.

8. Each magnet, when mounted, must have its centre upon one of the chalk lines which have been mentioned, or vertically above one of the chalk lines (as for instance, on the outside or in the inside of the binnacle, or any other erection,) or vertically below it, or vertically above or below their intersection. This condition is essential to correction. It matters little which of the two cross lines is used; but the centre of either magnet must not be upon, or above, or below, either of the angles between the chalk lines.

9. The correction of each compass will require one magnet (which I will call A) placed with its length athwart-ships, and another magnet (which I will call B) placed with its length fore and aft. It matters little upon which of the chalk lines these magnets are placed; but I recommend that magnet A be placed on the fore-and-aft line, and magnet B on the athwart line, because then the compass will be subject to no error when the ship is heeling or pitching.

10. The operator must also be provided with a box of small iron chain, or a box of nails (provided they are not all laid in the same position) or a box of small pieces,

of malleable iron of any shape, one for each of the ship's compasses: the box may be six or seven inches long, and of half that breadth and depth. When used, its centre must be above one of the chalk lines (the subsequent experiments will discover which is the proper line) with its end towards the centre of the compass: its centre must be at the same height as the centre of the compass.

These preliminaries being understood, we shall now proceed to the actual operation.

11. Mount the ship's compasses in their places, if they be very good, or else mount the delicate compasses mentioned in Article 3, on any convenient stands, in such a manner that the centre of the needle of each is exactly in the same place which the centre of the needle of the ship's compass will occupy

12. Place the ship with her head exactly north, or exactly south (magnetic,) as ascertained by viewing the masts, or proper signals attached to the head and stern, with the delicate azimuth compass on shore. The ship's compasses will now probably be found considerably in error.

13. Bring the magnet A (no other magnet being near) and, keeping it most carefully in its proper position (that is, with its length exactly athwart-ships) slide it along the deck, or along the ceiling, or along the side of the binnacle, &c. to which it is proposed to fix it, with its centre upon the chalk line, till the ship's compass points correctly; then fix it in a temporary manner. Perform the same operation for all the compasses in the ship.

14. It will be prudent to turn the vessel half round (that is, to place her head south, if it was north before); and, if the operation No. 13 has been carefully performed, the ship's compass will be found correct in this position also. If it is not correct, the operation must be repeated, till the error in both positions of the ship is made as small as can be.

15. Leave the magnet A as fixed, and place the vessel with her head accurately east or west, as ascertained by the compass on shore; the ship's compasses now will probably be found considerably in error. Bring the magnet B, and, holding it most carefully in its proper position (that is, with its length fore and aft) slide it along the deck, or ceiling, &c. where it is to be fixed, keeping its centre upon the chalk line, till the ship's compass points exactly right; then fix the magnet B in a temporary manner. Perform the same operation for all the compasses in the ship.

16. Try the compasses now with the vessel's head in the four positions, N., E., S., W.; if the operation have been carefully performed, the compasses will all agree in those positions with the shore-compass; if they do not, the operation, or some parts of it, must be repeated till they do; this will very rarely be necessary. The magnets may now be permanently fixed.

17. Now place the ship with her head exactly north-east or south-west, as shown by the shore-compass—the ship's compasses will, perhaps, be found in error (the error will seldom exceed three degrees). If the needle of one of the ship's compases point too much to the right, the box of chain must be placed on the starboard or larboard side (it matters not which); if the needle point too much to the left, the box of chain must be placed on the fore or aft side.

18. Instead of this, the ship may be placed with her head exactly north-west or south-east; then, if the needle point too much to the right, the box of chain must be placed on the fore or aft side; if it point too much to the left, the box of chain must be placed on the starboard or larboard side. The distance must be determined by trial, till the compass points exactly right.

19. When this is done, the compass will be correct in all positions of the ship.

PROPORTIONS OF BEAUTY IN SIMPLE FIGURES.

In ordinary architecture, whether that of detached buildings or continuous rows in streets, and whether in the exterior or the interior, the rectangle is the principal figure which occurs, and in many respects it has advantages over most others. It is somewhat singular, however, that not only common builders, but architects of eminence, appear to have no principle of beauty upon which to regulate the proportions of the rectangles they employ. In consequence of this, we have some

buildings—as for example the Bank of England, and to a certain degree the National Gallery—so disproportionate in height to the length of the front, that they seem not only dwarfs, but actually dwarfed below their real dimensions. In other cases, again, we have a building with small extent of frontage run up to such a height that every appearance of stability is destroyed, and one feels alarmed least every gust of wind should blow it down. It is true that in London and other crowded and populous places, where ground is of great value, there exists a strong temptation to this disproportionate height of buildings; although in the new erections of some of the greatest thoroughfares, one step at least has been made to a better taste; and time may bring about another, more especially with the stimulus of such examples as that splendid building of which the elevation is given in our first number.

Our present purpose, however, is not to criticise buildings, but to inquire into the principle of beauty in the proportions of rectangular surfaces or apertures. The square may be taken as the fundamental rectangle, from which all the others are deviations; and any one who studies a square will find that the impression which it leaves on the mind is that of strength without any beauty. A detached building with a perfectly square front, the face of a square dado of a column, a square window, or, in short, any square which tells distinctly either as a piece of matter or as an opening, will be found to give an impression of strength, but without any mixture of the feeling of beauty.

Again, the very same surface as the square presents, that is, the same measure of surface, may be represented by a countless number of rectangles, until at last the length becomes indefinitely great, and the breadth indefinitely small, and the surface ceases to be a quantity admitting of numeral expression—the well known principle of equality in surface, among all these rectangles, being the product of the length and breadth always the same. When the ultimate rectangle vanishes into a line, the elements, and consequently the idea of strength is completely lost; and the line expresses almost weakness or instability, which has just as little of the expression of beauty in it as the square, which expresses absolute strength.

It follows from this, that the beautiful figure is to be sought for somewhere intermediate between these; and the question to be solved is, what are the proportions of this figure. We have said that the practice of ordinary builders and of many architects shows, that with them this question is altogether indeterminate; and so they apportion the length and breadth—say, for instance, of windows, according to chance or custom, or to one knows not what. The result is that we find one building with windows so narrow in proportion to their height that they appear like vertical fissures in the wall; while other openings are so low in proportion to their breadth that one feels as if the intermediate walls had been crushed down by too severe a load.

As beauty is not a feeling that can be clearly referred to any mathematical or physical basis, we can find out the dimensions of beauty only by analogy; and this analogy, even in the simple case of the rectangle, is a matter of some difficulty, or at least the clue to it is not quite self-evident. When however we begin to consider the endless series of rectangles between the square and the interminable straight line into

which they ultimately vanish, we find that there is one among the number which possesses properties that neither are nor can be possessed by any of the others; and this is the most likely one to be the rectangle of beauty.

This rectangle is the one which, though bisected continually, shall have all the sections of the same proportionate shape—that is, the breadth of each of them exactly the same fraction of the length as in all the others. It is not difficult to see what must be the proportions of this rectangle; for, as the whole and the half of it are similar, and as the corresponding sides are similar figures, are proportionals, we have this analogy:

As the length of the rectangle
is to its breadth;
so is the breadth
to half the length: Therefore,

if the length is given, the breadth can be found; or, if the breadth is given, the length can be found, and consequently we have the means of constructing the rectangle of any dimensions we please, by having one of those dimensions given.

By the well-known property of proportionals, the above analogy forms this equation:—the square of the breadth is equal to the length multiplied by its half; or, calling the length 1, the corresponding breadth will be the square root of $\frac{1}{2}$. The square root of a fraction being always a greater number than that fraction itself, the breadth of our rectangle must be more than half the length; and in order to determine how much, the most convenient method is to reduce them to the corresponding decimal .5, and extract the square root by the ordinary operation. Upon doing this, we find the square root of $\frac{1}{2}$ comes to .7071; so that, if the length of the rectangle is 1, the breadth must be this decimal number extended as far as may be neeessary; or, if we annex as many 0 to 1 as there are figures in the decimal, we have the proportion:

Length 10,000; breadth 7,071.

These numbers are too large for common purposes; and as the second figure of the breadth is 0, it will be quite near enough to take the approximate dimensions,

Length 10; breadth 7:

and by means of these, we can find by simple multiplication and division the length answering to any breadth, or the breadth answering to any length: and, if a rectangle is actually constructed having these proportions, it will be found much more handsome, whether placed to stand on the breadth or on the length, than any rectangle of a different shape. We need hardly add that the length may be found mechanically, if the breadth is known; for, by the well-known property of a square, if the breadth be equal to the side of a square, the length will be equal to the diagonal of the same.

As an example of the application of this, we may mention that if a window is made of these proportions, and divided into the same number of panes, in height and in breadth, those panes will not only be all equal and similar, but they will be similar to the general aperture of the window itself; and the dissimilarity of common windows and their panes is a deformity which obtrudes itself upon one in viewing almost any

building. In the case of what is called a French window, opening in two leaves, a very handsome one may be obtained by four large panes, or one of greater strength, and still beautiful, with four panes in each leaf, lying on their length.

The same principle is applicable to the circle, and the countless series of ellipses between the circle and the interminable straight line into which the final ellipse vanishes; but this, together with the illustrative diagrams, we shall reserve for a future number. London Surveyor, &c.

On a simple mode of obtaining from a common Argand Oil Lamp a greatly increased quantity of Light: in a Letter from Sir J. Herschel, Bart. *to the Editors of the London and Edinburgh Philosophical Magazine.*

The following simple, easy and unexpensive mode of greatly increasing the quantity of light yielded by a common Argand burner, has been used by me for some years, and is adapted to the lamp by which I write, to my greatly increased comfort. It consists in merely elevating the glass chimney so much above the usual level at which it stands in the burners in ordinary use that its *lower* edge shall clear the *upper* edge of the circular wick by a space equal to about the fourth part of the exterior diameter of the wick itself. This may be done to any lamp of the kind, at a cost of about sixpence, by merely adapting to the frame which supports the chimney four pretty stiff steel wires, bent in such a manner as to form four long upright hooks, in which the lower end of the chimney rests; or still better if the lamp be so originally constructed as to sustain the chimney at the required elevation without such addition, by thin laminæ of brass or iron, having their planes directed to the axis of the wick.

The proper elevation is best determined by trial; and as the limits within which it is confined are very narrow, it would be best secured by a screw motion applied to the socket on which the laminæ above mentioned are fixed, by which they and the chimney may be elevated or depressed at pleasure, without at the same time raising or lowering the wick. Approximately it may be done in an instant; and the experiment is not a little striking and instructive. Take a common Argand lamp, and alternately raise and depress the chimney vertically from the level where it usually rests, to about as far above the wick, with a moderately quick but steady motion. It will be immediately perceived that a vast difference in the amount of light subsists in the different positions of the chimney, but that a very marked and sudden *maximum* occurs at or near the elevation designated in the commencement of this letter: so marked indeed as almost to have the effect of a flash if the motion be quick, or a sudden blaze as if the wick-screw had been raised a turn. The flame contracts somewhat in diameter, lengthens, ceases to give off smoke, and attains a dazzling intensity.

With this great increase of light there is certainly not a correspondingly increased consumption of oil. At least the servant who trims my lamp reports that a lamp so fitted consumes very little if any more oil than one exactly similar on the common plan.

On increasing the Light of a Common Argand Lamp. In a Letter to the Editors of the London and Edinburgh Philosophical Magazine and Journal for July. By C. HOLTHOUSE.

GENTLEMEN—Having seen in the number of your Magazine of March last, a letter from Sir John Herschel, "On a simple mode of obtaining from a common Argand oil lamp a greatly increased quantity of light," I take the liberty of sending you a few observations of my own on the same subject: they are mostly corroborative of what has been advanced by the distinguished philosopher before alluded to; and if you think them worth insertion, they are very much at your service.

The size and brilliancy of the flame in a common Argand oil lamp depend chiefly upon the shape and dimensions of the glass chimney, and its position in relation to the flame; but as the contrivances which render the latter more brilliant at the same time diminish its bulk, there is a limit, beyond which we cannot increase the brightness without diminishing the illuminating power; the increase in brilliancy not compensating for the diminished bulk of the flame. Sir J. Herschel has not told us what is the diameter of his Argand burner, or the diameter and form of his glass chimney; but from the description he has given us of his method of producing a greatly increased quantity of light, I presume he must have used one of those chimneys which are commonly employed only for gas lamps, being a simple cylinder about nine inches long and of equal diameter throughout. But this kind of chimney is ill adapted for enlivening a flame, and seems merely to serve for protecting it against currents of air, although when employed in the manner recommended by Sir John Herschel its office is reversed; it becomes a mean of increasing the intensity of combustion, but serves no longer as an efficient protector; and in this latter respect it is imperfect; for admitting the advantages which arise from the increase of light, still these can only be available while a lamp is at rest: the instant it is moved the flame must necessarily impinge against the walls of the chimney, at the great risk of breaking it, and with a certainty of smoking it. But an equal degree of light, and not subject to the inconvenience just mentioned, can be obtained by one of the chimneys ordinarily made use of in the common table lamp, which consists of a base or larger cylinder, upon which the pillar or smaller cylinder is joined by a horizontal part termed the shoulder: upon the height of the pillar of this chimney, the proportion of its constituent parts to each other and to the burner, and their position in relation to the latter, depend the efficient burning of the lamp.

And first with reference to the *height*. The most obvious effect of lengthening a chimney is, to render the flame more flickering and unsteady, at the same time its brightness is slightly increased, and its bulk diminished: the larger the diameter of the chimney compared with the burner, the less marked are these changes. On lengthening a chimney whose pillar had a diameter of $1\frac{1}{8}$ inch, to 3 feet, and placing it on a lighted lamp, well turned on, whose wick had $\frac{7}{8}$ of an inch diameter, the flame immediately split into several small flickering cones, the largest of which was not above five or six lines in height; as the chimney was shortened, so did the flame in the same proportion become steadier

and more uniform, till at 7 inches, which was the length of the pillar of this chimney, it was as steady as could be desired. One fact was strikingly obvious during this experiment, viz. that the increase of brilliancy was by no means commensurate with the loss of light occasioned by the smaller bulk and great unsteadiness of the flame. From several trials with chimneys of various lengths, I should say that a seven-inch pillar, for an Argand burner of the ordinary size, is well adapted for giving brightness, and at the same time steadiness to a flame.

To ascertain the best *diameter* for the chimney, eight pieces of tin were procured, each two inches square, and having a circular aperture in their centre, varying from $1\frac{1}{2}$ to $\frac{1}{2}$ an inch in diameter; these, by turns, were fixed to the moveable stage of a microscope, and then placed directly over the flame of a lamp, so that the centre of the circle of the Argand burner should correspond with the centre of the circular aperture in the tin; a simple* glass chimney being now placed upon the tin, the whole apparatus was lowered till the flame of the lamp passed through the aperture in the tin. By trying the different sizes one after the other, we were able to decide upon that which gave the greatest degree of illumination, and by raising and lowering the apparatus over the flame, the best height from the level of the wick for obtaining the greatest light was determined. The following are some of the results. The size of the flame was in a direct ratio with the size of the aperture in the tin, but its brilliancy was in an inverse ratio; in other words, the flame diminished in size, but increased in brilliancy, as the aperture through which it had to pass was lessened. The effect produced by chimneys of different diameters, but of equal length, provided the aperture in the tin over which they were placed remained the same, was so trifling, that it was scarcely appreciable; the diameter of the aperture in the tin being for instance one inch, and that of the chimney the same, no material alteration in the brilliancy or bulk of the flame was produced when a chimney of double the diameter was substituted for it. I need hardly observe, that the diameter of the chimney must not be less than that of the tin. I said at the commencement of this letter, that there was a limit beyond which we could not increase the brightness of the flame without diminishing its illuminating power. I am not at present prepared to say where this precise point is; but I can assert without fear of contradiction, that an aperture of $1\frac{1}{8}$ of an inch diameter, for a lamp whose wick is $\frac{7}{8}$ of an inch, is a size well calculated for giving a great degree of brilliancy to the flame, without materially diminishing its bulk.

We come now to the consideration of the best height for placing the plate of tin above the wick of the lamp: this appears to be from $\frac{1}{4}$ to $\frac{3}{8}$ of an inch, which is that specified by Sir J. Herschel, supposing his burner to have an inch diameter: when we go below this, the flame becomes brighter, less coniform, and shorter; the continuity of its circle is interrupted; chasms form in it, producing the appearance of so many distinct flames; and when the tin has reached the level of the wick, the lamp is well nigh extinguished. Sir J. Herschel, in describing the

* When I apply the term *simple* to a chimney, I wish to be understood as speaking of those cylinders of uniform diameter from end to end; those composed of two parts, I shall, to prevent unnecessary tautology, designate *compound*.

effect produced on the flame by raising and lowering the chimney, has suggested that it would be an improvement were our common lamps provided with a mechanism for this purpose: this has actually been done on the continent, and in this country by Mr. Samuel Parker of Piccadilly, the flame of whose hot-oil lamp is regulated entirely by raising and lowering the chimney, the wick remaining stationary. Now if a number of glass chimneys be made, the diameter of whose pillars shall be the same as those of the apertures in the tin, and these be suspended over the flame with their narrow end downwards, we shall have the same result: but if, instead of this, they be placed in the usual manner on their support, the large end lowermost, we shall still have precisely the same result, provided the commencement of the pillar bear the same position in reference to the wick as the upper end did when suspended over it. The diameter of $1\frac{1}{8}$ inch, which I have named as a good size for having the pillar of the chimney, is eligible likewise on another account: there is less danger of its becoming smoked, to which it would be very liable were it of smaller dimensions than that just specified. The base of the chimney may be $1\frac{3}{4}$ or 2 inches in diameter, and its shoulder should form a right angle with the level of the burner, about $\frac{1}{2}$ an inch above it. This is a form of chimney which I have proved to be well fitted for giving a degree of light very superior to what is seen in Argand lamps having the ordinary sized chimneys. Dr. Ure, in a very interesting paper read before the Institution of Civil Engineers in June last, seems to give the preference to chimneys with rounded shoulders; these certainly give greater steadiness to the flame, and if the light is equal to that afforded by the rectangular shouldered ones, they should be preferred.

One more point, which was barely touched upon by Sir J. Herschel, yet remains to be decided: Is this superior splendor of the flame attended by an increased consumption of oil? If we reasoned from analogy, we should certainly reply in the affirmative; intensity of combustion being ever attended with corresponding consumption of the combustible material. But to place this beyond a doubt, the following experiment was undertaken: Two Argand lamps, having wicks and chimneys of the same diameter and length, and furnished with the same kind of oil, were placed in a pair of scales, each at an equal distance and elevation from the centre of a sheet of white paper pasted on the wall. On being lighted, the flames were regulated till the shadows cast by a small ruler had an equal depth; when this had been fairly determined both by myself and others, weights were put into the stand containing the lighter lamp, till the two exactly balanced each other. The chimney was now quickly removed from one of the lamps, and another substituted for giving a clear white flame, the time being at the same moment noted: they were allowed to burn for 42 minutes, and were then simultaneously extinguished. At the expiration of this time, the lamp burning with the bright flame had consumed 100 grains more than the other. The experiment being repeated, but with smaller flames, the increased consumption of oil in the bright burning lamp was 50 grains. Whether this greater expenditure of oil is balanced by the increased degree of illumination, and the solution of some other interesting questions connected with this subject, I shall reserve till a future period.

PROGRESS OF NATURAL HISTORY.

Extract from Dr. Storer's Report on Bell's "British Reptiles." Read before the Boston Society of Natural History.

Singular as it may appear, but *one* of the *Colubridæ* is found in Great Britain—the natrix torquata, common snake; which, we are here told, "inhabits most of the countries of Europe, from Scotland and the corresponding latitude of the continent to Italy and Sicily." The following curious anecdote is related of the manner in which they manage their prey and each other: "On placing a frog in a large box in which were several snakes, one of the latter instantly seized it by one of the hinder legs, and immediately afterwards another of the snakes took forcible possession of the fore leg of the opposite side. Each continued its inroads upon the poor frog's limbs and body, until at length the upper jaws of the two snakes met, and one of them in the course of its progress slightly bit the jaw of the other: this was retaliated, though evidently without any hostile feeling; but after one or two such accidents, the most powerful of the snakes commenced shaking the other, which still had hold of the frog, with great violence, from side to side against the sides of the box. After a few moments' rest, the other returned the attack; and at length, the one which had last seized the frog, having a less firm hold, was shaken off, and the victor swallowed the prey in quiet. No sooner was this curious contest over, than I put another frog into the box, which was at once seized and swallowed by the unsuccessful combatant." Our author, immediately after relating this anecdote, observes: "The frog is generally alive not only during the process of deglutition, but even after it has passed into the stomach. I once saw a very small one, which had been swallowed by a large snake in my possession, leap again out of the mouth of the latter, which happened to gape, as they frequently do immediately after taking food. And on another occasion, I heard a frog distinctly utter its peculiar cry several minutes after it had been swallowed by the snake." This reminds us of the anecdote related by Harlan,* who, speaking of the tenacity of life exhibited by the *Rana clamata*, observes: "A dog of Mr. Bartram's having accidentally swallowed one of these animals, it was observed to struggle and cry piteously for at least *half an hour*, to the great diversion of the spectators, and no small confusion of the dog, who was at a loss to comprehend this species of intestinal eloquence." Like many of our snakes, the *torquata* may be easily tamed; our author remarks: "I had one many years since, which knew me from all other persons; and when let out of his box, would immediately come to me, and crawl under the sleeve of my coat, where he was fond of lying perfectly still, and enjoying the warmth. He was accustomed

* "Descriptions of several new species of Batracian Reptiles, with observations on the Larvæ of Frogs. By Richard Harlan, of Philadelphia." Silliman's Journal, Vol. X, p. 63.

to come to my hand for a draught of milk every morning at breakfast, which he always did of his own accord; but he would fly from strangers, and hiss if they meddled with him." Many of the members of this Society undoubtedly remember having seen, several years since, accounts in the newspapers of snakes being carried to Ireland, and that they were increasing there. The facts connected with this attempt to introduce these animals into Ireland are thus clearly shown by a letter to the author from Mr. Thompson: "In this order *(Ophidia)* there is not now, nor I believe ever was there, any species indigenous to Ireland. In the Edinburgh New Philosophical Journal for April, 1835, it is remarked, 'We have learned from good authority that a recent importation of snakes has been made into Ireland, and that at present they are multiplying rapidly within a few miles of the tomb of St. Patrick.' I never," proceeds Mr. Thompson, "heard of this circumstance until it was published, and subsequently endeavored to ascertain its truth, by inquiring of the persons about Downpatrick, (where the tomb of St. Patrick is) who are best acquainted with these subjects, not one of whom had ever heard of snakes being in the neighborhood. Recollecting that about the year 1831 a snake, (natrix torquata) immediately after being killed at Milecross, was brought by some country people, in great consternation, to my friend Dr. I. L. Drummond, I thought this might be one of those alluded to, and recently made inquiry of James Cleland, Esq. of Ruth Gael House, (County Down) 25 miles distant in a direct line from Downpatrick, respecting snakes said to have been turned out by him; I was favored by that gentleman with the following satisfactory reply: 'The report of my having introduced snakes into this country is correct. Being curious to ascertain whether the climate of Ireland was destructive to that class of reptiles, about six years ago I purchased half a dozen of them in Covent-Garden Market, in London; they had been taken some time, and were quite tame and familiar. I turned them out in my garden; they immediately rambled away; one of them was killed at Milecross, three miles distant, in about a week after its liberation, and three others were shortly afterwards killed within that distance of the place where they were turned out; and it is highly probable that the remaining two met with a similar fate, falling victims to a reward which it appears was offered for their destruction.'"

Besides the *Natrix torquata*, but one more of the *Ophidia* is noticed; the *Pelius Berus*, common adder; which, to use the words of our author, "is the sole British representative of any of the poisonous groups of serpents, and indeed the only poisonous reptile indigenous to this country."

The history of the *Rana temporaria*, common frog, is very interesting; the changes which take place in its development from the *ovum* to the perfect animal, are pointed out with a clearness which shows how well they are understood by the describer. In a pleasing anecdote, our author proves its capability of being tamed; he states that his friend, Dr. Wm. Roots, of Kingston, informed him, "that he was in possession for several years, of a frog in a perfect state of domestication. It appears that the lower offices of his house were what is commonly called under-ground, on the banks of the Thames. That this little reptile

accidentally appeared to his servants occasionally issuing from a hole in the skirting of the kitchen, and that during the first year of his sojourn, he constantly withdrew upon their approach; but from their showing him kindness, and offering him such food as they thought he could partake of, he gradually acquired habits of familiarity and friendship; and during the following three years, he regularly came out every day, and particularly at the hour of meal-time, and partook of the food which the servants gave him. But one of the most remarkable features in his artificial state of existence, was his strong partiality for warmth, as during the winter seasons he regularly (and contrary to the cold-blooded tendency of his nature) came out of his hole in the evening, and directly made for the hearth in front of a good kitchen fire, where he would continue to bask and enjoy himself until the family retired to rest. There happened to be at the same time a favorite old domestic cat, and a sort of intimacy or attachment existed between these two incongruous inmates; the frog frequently nestling under the warm fur of the cat, whilst the cat appeared extremely jealous of interrupting the comforts and convenience of the frog. This curious scene was often witnessed by many besides the family."

The manner in which the *Bufo vulgaris*, common toad, sheds its cuticle, is described very instructively: "Having often found, among several toads which I was then keeping for the purpose of observing their habits, some of brighter colors than usual, and with the surface moist and very smooth, I had supposed that this appearance might have depended upon the state of the animal's health, or the influence of some peculiarity in one or the other of its functions; on watching carefully, however, I one day observed a large one, the skin of which was particularly dry and dull in its colors, with a bright streak down the medial line of the back; and on examining further, I discovered a corresponding line along the belly. This proved to arise from an entire slit in the old cuticle, which exposed to view the new and brighter skin underneath. Finding therefore what was about to happen, I watched the whole detail of this curious process. I soon observed that the two halves of the skin, thus completely divided, continued to recede further and further from the centre, and became folded and rugose; and after a short space, by means of the continued twitching of the animal's body, it was brought down in folds on the sides. The hinder leg, first on one side and then on the other, was brought forward under the arm, which was pressed down upon it, and on the hinder limb being withdrawn, its cuticle was left inverted under the arms, and that of the anterior extremity was now loosened, and at length drawn off by the assistance of the mouth. The whole cuticle was thus detached, and was now pushed by the two hands into the mouth in a little ball, and swallowed at a single gulp."

Four species of *Salamandridæ* are described in the volume before us. The history of the *Triton cristatus*, common water-newt, is very elaborate; our author has carefully made the same observations as *Rusconi*, and adds his testimony to the value of that writer's investigations with regard to the development of this species. We are here told that *Spallanzani* supposed that the eggs when deposited, fell at once to the bottom of the water, and that "*Cuvier* asserts that they are pro-

duced by several at a time, attached to each other like beads." Now, although *Rusconi* first published an accurate account of this process, our author had several times personally observed it before he was acquainted with Rusconi's book. It appears that the egg, instead of being carelessly dropped, is most curiously guarded. "The female, selecting some leaf of an aquatic plant, sits as it were upon its edge, and folding it by means of her two hinder feet, deposits a single egg in the duplicature of the folded part of the leaf, which is thereby glued most securely together, and the egg is thus effectually protected from injury."*

Silliman's Journal.

MISCELLANEOUS.

Carburetted Hydrogen.—The students at West Town boarding school, Chester county, Penn. for want of a better place, bathe in a mill-pond of very limited extent. Chester Creek, a mere brook, enters at the northern extremity. The banks on all sides are covered with timber, from which an abundance of leaves and decayed wood find their way into the pond. Hence the great quantity of gas, that every person wading in the pond must have noticed.

I first visited the place in the year 1834; and on noticing the gas, determined to collect some for the purpose of examination. Taking as apparatus a bell-glass furnished with a stop-cock, and a taper, and as companion an assistant teacher in the school, (now assistant superintendent at Harnford School) we proceeded to the pond, readily filled the receiver, and fired the gas issuing from the stop-cock. We next proposed to burn the bubbles as they arose from the water. On stirring the leaves the gas ascended in large quantities, affording an admirably successful experiment. No sooner was the lighted taper brought near the surface of the water, than we found ourselves enveloped in flames. To retreat was of course the first impulse. Fire and water, though usually antagonist elements, in this instance formed an alliance so friendly, that to our consternation as well as amusement we were pursued to the very banks. We however escaped with but a slight scorching. We soon found means, however, to repeat the experiment with perfect impunity. This was done by selecting a position where the water was three or four feet deep, lying on our backs with our legs extended, and allowing no part of our persons to touch the bottom except the feet, over which the gas might be inflamed, and would continue to burn as long as the leaves were stirred beneath. In this way we could cause the flame to follow us several rods. By raising the feet at pleasure it would expire.

With this experience, we determined to repeat the experiment in the presence of the scholars. Their next visit to the pond was deferred till evening, that darkness might render the phenomenon more imposing. The boys were simply informed that "Master Moses was a going to

---

* An abstract of Rusconi's memoir on the "Natural History and Structure of the Aquatic Salamander," with an illustrative plate, may be found in No. XVII of the Edinburgh Philosophical Journal, for 1823.

set the river afire," and that their assistance would be necessary to the satisfactory performance of the experiment. The usual preparation for bathing being made, some fifty of the less timid entered the water, with the injunction to step as lightly as possible till the pond was discovered to be on fire, when all would be at liberty to proceed as would best suit their inclinations. We soon came to a favorable spot, and the gas beginning to come up pretty freely, a lighted taper was brought near the surface, when in an instant a lambent flame played upon our unprotected bodies, and cast a gloomy light upon the surrounding forest. disclosing here and there amid the thick underbrush the pale faces of their shouting companions who remained upon the bank. In the hurry, the injunction to step lightly was forgotten, and the general stir of the leaves which took place extricated the gas in such abundance that the flame rose several feet above our heads. As they separated from me, I raised my feet from the bottom, and found it much more difficult to suppress my laughter than to extinguish the flames. Silliman's Journal.

Petroleum Oil Well.—About ten years since, whilst boring for salt water, near Burksville, Kentucky, after penetrating through solid rock upwards of 200 feet, a fountain of pure oil was struck, which was thrown up more than twelve feet above the surface of the earth. Although in quantity somewhat abated after the discharge of the first few minutes, during which it was supposed to emit 75 gallons a minute, it still continued to flow for several days successively. The well being on the margin and near the mouth of a small creek emptying into Cumberland River, the oil soon found its way thither, and for a long time covered its surface. Some gentlemen below applied a torch, when the surface of the river blazed, and the flames soon climbed the most elevated cliffs, and scorched the summit of the loftiest trees. It ignites freely, and produces a flame as brilliant as gas. Its qualities were then unknown; but a quantity was barreled, most of which soon leaked out. It is so penetrating as to be difficult to confine in a wooden vessel, and has so much gas as frequently to burst bottles when filled and tightly corked. Upon exposure to the air it assumes a greenish hue. It is extremely volatile; has a strong, pungent and indescribable smell, and tastes much like the heart of pitch pine.

For a short time after the discovery, a small quantity of the oil would flow whilst pumping the salt water, which led to the impression that it could always be drawn by pumping. But all subsequent attempts to obtain it, except by a spontaneous flow, have entirely failed. There have been two such flows within the last two years. The last commenced on the 4th of July last, and continued about six weeks, during which time twenty barrels of oil were obtained. The oil and the salt water, with which it is invariably combined during these flows, are forced up by the gas above 200 feet into the pump, and thence through the spout into a covered trough, where the water soon becomes disengaged and settles at the bottom, whilst the oil is readily skimmed from the surface. A rumbling noise resembling distant thunder uniformly attends the flowing of the oil, whilst the gas which is then visible every day at the top of the pump, leads the passing stranger to inquire whether the well is on fire. New Orleans Bulletin.

Sweden.—A very important ordinance, and one which is a great step towards a more liberal commercial system, has lately been published by the Swedish government, by which the export duty on fine iron is to be reduced by one half.

Effects of Cultivation on Climate.—Without cultivation, few climates would be healthy or agreeable. In countries to which the labors of civilized man have never been extended, the rivers, spreading themselves over the low grounds, form pestilential marshes; and forests, thickets and weeds are so numerous and impenetrable, as to prevent the earth from receiving the beneficial influence of the sun's rays. The air, from these causes, is constantly filled with noxious exhalations. But the efforts of the human race, conducted with skill and perseverance, produce a surprising change: marshes are drained; rivers embanked; the soil, broken up by the plough, is exposed to the sun and wind; and the clearing away of the forests raises the temperature, and allows a freer circulation to the atmosphere. There is little doubt that many parts of Europe enjoy a milder climate now than they did in the time of the Romans, or even at periods much more recent. Several districts in North America have experienced, as the country has become more widely settled, a similar improvement of climate. The destruction of forests, may, however, be carried to a pernicious extent, either by depriving a country of shelter from particular winds, or (especially in hot climates) by lessening too much the quantity of moisture, it being well known that there is a great evaporation from the leaves of vegetables. The sultry atmosphere and dreadful droughts of the Cape de Verd Islands are owing to the destruction of the forests; and Greece, Italy and other countries are said to have been deteriorated in climate from the same cause. It is attributed to this also, that the southern part of Iceland is more accessible than formerly to the cold which proceeds from the Arctic Ocean. Library of Useful Knowledge.

Supply of Coal.—The enormous consumption of coals produced by the application of the steam-engine in the arts and manufactures as well as to railways and navigation, has of late years excited the fears of many as to the possibility of the exhaustion of our coal mines. Such apprehensions are however altogether groundless. If the present consumption of coal be estimated at sixteen millions of tons annually, it is demonstrable that the coal fields of this country would not be exhausted for many centuries. But in speculations like these, the probable if not certain progress of improvement and discovery ought not to be overlooked; and we may safely pronounce, that long before such a period of time shall have rolled away, other and more powerful mechanical agents will supersede the use of coal. Philosophy already directs her finger at sources of inexhaustible power in the phenomena of electricity and magnetism. The alternated decomposition and recomposition of water, by magnetism and electricity, has too close an analogy to the alternate processes of vaporization and condensation not to occur at once to every mind: the development of the gases from solid matter by the operation of the chemical affinities, and their subsequent condensation into the liquid form, has already been essayed as a source of power. In short,

the general state of physical science at the present moment; the vigor, activity and sagacity with which researches in it are prosecuted in every civilized country; the increasing consideration in which scientific men are held, and the personal honors and rewards which begin to be conferred upon them—all justify the expectation that we are on the eve of mechanical discoveries still greater than any which have yet appeared; and that the steam-engine itself, with the gigantic powers conferred upon it by the immortal Watt, will dwindle into insignificance in comparison with the energies of nature which are still to be revealed; and that the day will come when that machine which is now extending the blessings of civilization to the most remote skirts of the globe will cease to have existence except in the pages of history. Dr. Lardner.

Antiquarian Discoveries in France.—A discovery has recently been made at Bougon, near Mothe-Saint-Heray, in the Two Sevres, of a tumulus, which promises to throw great light on the civilization of the ancient Celts. A gallery and vast grotto has been opened. It is formed of nine stones in erect positions, covered by a slab 26 feet 3 inches in length. The interior is completely filled with bones. The head of each skeleton touches the walls of the grotto, and by the sides of each, vases of baked earth containing provisions for the use of the deceased in the other world, the wahala or paradise promised to the brave. Nuts and acorns are found in these vases in perfect preservation. There have also been found two hatchets and two knives made of flint, several smaller sharp instruments, the use of which is not known, two collars or necklaces, one of shells and the other of baked earth, several bear's tusks, the bones of a dog, and a plate, upon which there are fragments of a rude design. Four of these vases are perfect: two of them very much resemble flower-pots; a third has the form of a soup-tureen; and the fourth, though much the smallest, is the most curious, as it is the cup of a druid. The tumulus is 200 paces in circumference, and between 18 and 20 feet high. Its formation may be placed at 2000 years ago. The vases and utensils attest the infancy of the arts, and the nascent civilization of a barbarous people. Quotidienne.

Progress of Iron Ship Building.—The confidence entertained in the good properties of iron vessels, and particularly their advantage in combining strength with that light draught of water requisite in some branches of trade, in peculiar localities, is becoming daily more and more confirmed, by the success, both at home and abroad, of the ships built of that material, and the improvements in their construction which experience enables the builders to introduce. It is not therefore improbable but in twenty years hence, or perhaps within a shorter period, one half of our mercantile marine may be of iron, copper, or some composition of various metals that may be wrought by hammer, or cast in pieces, and afterwards jointed, to any given mould or model.

Be this as it may, the construction of "steam" vessels of strong sheet iron is evidently much on the increase, particularly here and at Glasgow, the two ports that were the first, we believe, in this country, and are still the most successful (being put to their "metal") in directing their energies to steam navigation. The "iron fleet" of England is conse-

quently receiving rapid accessions; and not contented with turning out one vessel at a time, Mr. John Laird has several on the stocks at once, and on Saturday morning 6th ult. launched two from his yard at North Birkenhead by the same tide.

The first one launched was her Majesty's steam-vessel Dover, to be placed on the station between Dover and Calais, or Ostend. The following are her dimensions and capacity: Length (per measurement) 110 feet; breadth or beam do. 21 feet; tonnage about 230. The Dover is the first iron vessel belonging to the Admiralty, and on her success will no doubt depend the future adoption of vessels of her build by the government. She is of a remarkably fine model, having a degree of rotundity in her sides, with ample bearing, and a fineness in her lines, fore and aft, which will in all probability insure her a degree of speed and safety not yet attained by any steam-vessel of her size.

The second vessel launched was the Phlegethon: Length 157 feet 6 inches; breadth 26 feet; tonnage upwards of 500. She is intended for sea and river service, on we believe a foreign station, and will carry two long guns, one at the bow and one at the stern, to work within a circle. This vessel is also of a fine model, with ample bearings, so that she may carry sail when required, either with steam or without it, as her paddle-wheels, on a new principle, by Mr. Forrester, may when required be thrown out of gear. She is handsomely, and we may add, rakishly rigged as a two-masted schooner, and will we doubt not prove to be a clipper. Mr. Laird is now building three iron steam-vessels to compose the new expedition about to be sent by government up the river Niger, under the command of Capt. Trotter. Liverpool paper.

Asphalte.—This material has been used in lining the reservoirs and tanks of the Southampton Railway, and found to answer very well: it has also been used for covering terraces: in some situations it has not been very successful, but in others it is perfectly water-proof. An additional length of the footway in Whitehall has been laid with this material.

The substitution of boiling coal tar instead of water, with crushed caustic lime and screened gravel or sharp sand, in the usual proportions for making concrete, forms an admirable asphalte, perhaps equal to the foreign asphalte. Civil Engineer's Journal.

The Archimedes.—This experimental vessel is gradually working its way all round the coast, exhibiting its powers at the principal ports. It was at Liverpool last month. On the 10th ult. we find by the Liverpool Standard, she made a trip, and shortly before reaching the Crosby light-ship, the Duchess of Lancaster steam-ship was perceived making directly for the port; and as she was known to be a remarkably fast sailer, and Mr. Smith being desirous of proving the capabilities of the Archimedes, immediately 'put about,' and awaited the arrival of the former vessel. On coming up, the screw was immediately put in motion, and the two vessels went admirably together for some distance, though we are bound in fairness to state that the Duchess had a very slight advantage in respect of speed, owing, as will be seen from the subjoined comparison, to her proportions as to power, draught, &c.

being better adapted for quick sailing. The Archimedes had also the full strength of the tide to contend with, whilst her competitor ran the whole distance in the eddy. This is the first time the Archimedes has been beaten, with one or two slight exceptions.

	Archimedes.	Duchess of Lancaster.
Diameter of cylinder,	37 in.	40 in.
Stroke,	3 ft.	3 ft.
Tonnage,	237	238
Draught,	10 ft.	6 ft.
Estimated steam-power,	80-horse	90-horse
Length between perpendiculars,	107 ft.	120 ft.
Beam,	22½ ft.	20 ft.
Area of midship section at 10 ft. draught,	143 ft.	at 6 ft. 100 ft.

As there was a feeling on board relative to the slip or loss of power from the screw, the following explanation will doubtless be satisfactory: The screw, being 8 feet pitch, would, if working in a solid, advance 8 feet for each revolution; but working in a fluid, the relative difference between the speed of the screw and the vessel appears *at first sight* to be considerable, from the *supposed* oblique action of the propeller. The following mode of calculating the speed of both will show that the difference is barely one-sixth, which is considerably less than that of ordinary paddle-wheels.

"The number of revolutions of the engine per minute is 26, which, multiplied by the spur wheels 5⅓ times, gives that number of turns to the screw for one of the engine.

26	revolutions of the engine per minute.
5⅓	multiple.
138	revolutions of the screw per minute.
8	feet pitch of screw.
1104	*feet* traveled per minute.
20	being ⅓ of 60, to bring it into
22,080	*yards* per hour,

which, divided by 1760 (the number of yards in a statute mile) gives us 12 miles 160 yards per hour as the speed of the screw. Speed of the vessel for 26 strokes per minute, 10 2-5ths miles per hour by the log."

She left Liverpool on the 11th ult. for the Isle of Man, and performed the run in the short space of 7 hours and 25 minutes, which is an unusually quick passage. The Mona's Isle was fully two hours longer doing the same distance on the same day, starting about half an hour later than the Archimedes. The Mona is 10 horses power more than the Archimedes, with considerable less tonnage, and drawing two feet less water.

Dyeing Timber.—Amongst the subjects lately discussed in the French Academy of Sciences are, a discovery, by a Dr. Bourguet, for dyeing and preserving timber, and one for obtaining blue or red silk from silk-worms. Dr. Bourguet states, that if the lower part of the trunk of a tree be immersed, as soon as it is felled, in a preparation of pyroligneous acid, the preparation will be absorbed throughout the whole of the tree, and that the timber will subsequently resist decay. He states also,

that if coloring matter be placed in the liquid, it will be carried through all the vessels of the tree, even to the leaves, and be permanently fixed. As this gentleman has made frequent experiments, there appears to be no doubt of the correctness of his theory. The mode of obtaining blue or red silk from silkworms is kept a secret, except as to an admission that it depends on the food of the insect. M. Flourens, a member of the Academy, had previously ascertained that the flesh, and even the bones of animals, may be colored, by keeping them for a long period on food highly impregnated with coloring matter.

Transatlantic Steamers.—Comparison of the passages of the four lines of Sailing Packet Ships between Liverpool and New-York, with those of the Transatlantic Steam Ships, during the year 1839.

SAILING SHIPS.	Longest outward.	Shortest outward.	Average outward.	Longest homew'rd	Shortest homew'rd	Average homew'rd
	DAYS.	DAYS.	DAYS.	DAYS.	DAYS.	DAYS.
Old or Black Ball Line,	48 0	22 0	33 17	36 0	18 0	22 12
Dramatic Line,	38 0	23 0	30 12	25 0	17 0	20 12
Star Line,	45 0	27 0	36 0	28 0	21 0	24 0
Swallow-tail Line,	45 0	28 0	35 0	31 0	17 0	22 12
STEAM SHIPS.						
Great Western,	21 12	13 0	16 12	15 0	12 6	13 9
British Queen,	20 9	14 21	17 8	21 12	13 12	16 12
Liverpool,	18 12	16 0	17 4	27 0	13 18	15 16
Average of all the sailing ships,	44 0	25 0	34 1¼	30 0	18 6	
Average of all the steam ships,	20 3	14 15	17 0	21 4	13 4	15 4¼
Difference in favor of the steam ships,	23 21	10 9	17 1¼	8 20	5 2	7 13¼

The immense superiority, in point of speed, of the steam ships, will be fully evident on inspection of the above table; where the difference in the first instance is more than half; in the second, almost three-fifths; in the third, more than half; in the fourth, more than a quarter; in the fifth, near a third; and in the sixth, more than a third.

It must however be borne in mind that the transatlantic steam ships are yet in their infancy, whilst the sailing ships are perfection; there being no faster ships on the face of the globe than the New-York and Liverpool liners.

The Royal George.—Colonel Pasley began his proceedings for the removal of the wreck of the Royal George on the 1st of last month, but up to the 12th nothing very remarkable was effected. Two guns, the rudder, and a considerable quantity of timber, were recovered; but as these were merely the fragments of last year's work which the inclemency of the season prevented the engineers from picking up, no serious measures were deemed necessary till Tuesday, 12th ult. At 8 o'clock

being better adapted for quick sailing. The Archimedes had also the full strength of the tide to contend with, whilst her competitor ran the whole distance in the eddy. This is the first time the Archimedes has been beaten, with one or two slight exceptions.

	Archimedes.	Duchess of Lancaster.
Diameter of cylinder,	37 in.	40 in.
Stroke,	3 ft.	3 ft.
Tonnage,	237	238
Draught,	10 ft.	6 ft.
Estimated steam-power,	80-horse	90-horse
Length between perpendiculars,	107 ft.	120 ft.
Beam,	22½ ft.	20 ft.
Area of midship section at 10 ft. draught,	143 ft.	at 6 ft. 100 ft.

As there was a feeling on board relative to the slip or loss of power from the screw, the following explanation will doubtless be satisfactory: The screw, being 8 feet pitch, would, if working in a solid, advance 8 feet for each revolution; but working in a fluid, the relative difference between the speed of the screw and the vessel appears *at first sight* to be considerable, from the *supposed* oblique action of the propeller. The following mode of calculating the speed of both will show that the difference is barely one-sixth, which is considerably less than that of ordinary paddle-wheels.

"The number of revolutions of the engine per minute is 26, which, multiplied by the spur wheels 5⅓ times, gives that number of turns to the screw for one of the engine.

26	revolutions of the engine per minute.
5⅓	multiple.
138	revolutions of the screw per minute.
8	feet pitch of screw.
1104	*feet* traveled per minute.
20	being ⅓ of 60, to bring it into
22,080	*yards* per hour,

which, divided by 1760 (the number of yards in a statute mile) gives us 12 miles 160 yards per hour as the speed of the screw. Speed of the vessel for 26 strokes per minute, 10 2-5ths miles per hour by the log."

She left Liverpool on the 11th ult. for the Isle of Man, and performed the run in the short space of 7 hours and 25 minutes, which is an unusually quick passage. The Mona's Isle was fully two hours longer doing the same distance on the same day, starting about half an hour later than the Archimedes. The Mona is 10 horses power more than the Archimedes, with considerable less tonnage, and drawing two feet less water.

Dyeing Timber.—Amongst the subjects lately discussed in the French Academy of Sciences are, a discovery, by a Dr. Bourguet, for dyeing and preserving timber, and one for obtaining blue or red silk from silk-worms. Dr. Bourguet states, that if the lower part of the trunk of a tree be immersed, as soon as it is felled, in a preparation of pyroligneous acid, the preparation will be absorbed throughout the whole of the tree, and that the timber will subsequently resist decay. He states also,

that if coloring matter be placed in the liquid, it will be carried through all the vessels of the tree, even to the leaves, and be permanently fixed. As this gentleman has made frequent experiments, there appears to be no doubt of the correctness of his theory. The mode of obtaining blue or red silk from silkworms is kept a secret, except as to an admission that it depends on the food of the insect. M. Flourens, a member of the Academy, had previously ascertained that the flesh, and even the bones of animals, may be colored, by keeping them for a long period on food highly impregnated with coloring matter.

Transatlantic Steamers.—Comparison of the passages of the four lines of Sailing Packet Ships between Liverpool and New-York, with those of the Transatlantic Steam Ships, during the year 1839.

SAILING SHIPS.	Longest outward.	Shortest outward.	Average outward.	Longest homew'rd	Shortest homew'rd	Average homew'rd
	DAYS.	DAYS.	DAYS.	DAYS.	DAYS.	DAYS.
Old or Black Ball Line,	48 0	22 0	33 17	36 0	18 0	22 12
Dramatic Line,	38 0	23 0	30 12	25 0	17 0	20 12
Star Line,	45 0	27 0	36 0	28 0	21 0	24 0
Swallow-tail Line,	45 0	28 0	35 0	31 0	17 0	22 12
STEAM SHIPS.						
Great Western,	21 12	13 0	16 12	15 0	12 6	13 9
British Queen,	20 9	14 21	17 8	21 12	13 12	16 12
Liverpool,	18 12	16 0	17 4	27 0	13 18	15 16
Average of all the sailing ships,	44 0	25 0	34 1¼	30 0	18 6	
Average of all the steam ships,	20 3	14 15	17 0	21 4	13 4	15 4¼
Difference in favor of the steam ships,	23 21	10 9	17 1¼	8 20	5 2	7 13¼

The immense superiority, in point of speed, of the steam ships, will be fully evident on inspection of the above table; where the difference in the first instance is more than half; in the second, almost three-fifths; in the third, more than half; in the fourth, more than a quarter; in the fifth, near a third; and in the sixth, more than a third.

It must however be borne in mind that the transatlantic steam ships are yet in their infancy, whilst the sailing ships are perfection; there being no faster ships on the face of the globe than the New-York and Liverpool liners.

The Royal George.—Colonel Pasley began his proceedings for the removal of the wreck of the Royal George on the 1st of last month, but up to the 12th nothing very remarkable was effected. Two guns, the rudder, and a considerable quantity of timber, were recovered; but as these were merely the fragments of last year's work which the inclemency of the season prevented the engineers from picking up, no serious measures were deemed necessary till Tuesday, 12th ult. At 8 o'clock

in the morning, the red flags at Spithead announced that a great explosion was to be attempted; and at 11, one of those huge cylinders which have formerly been described, filled with 2116 lbs. of gunpowder, was lowered to the bottom. One of Col. Pasley's divers, (George Hall) who has acquired great expertness in these operations, descended his rope-ladder a little in advance of the cylinder, and succeeded in fixing it securely to one of the lower gudgeons or braces on the rudder-post, within six or eight feet of the keel. The diver having remounted, and the vessels being withdrawn to a safe distance, the enormous charge was ignited by means of the voltaic apparatus. Within less than two seconds after the shock was felt, the sea rose over the spot to the height of about 15 feet, or not quite half so high as it did on occasion of the great explosions last year—a difference ascribable, probably, to the cylinder on the present occasion having been placed under the hull instead of alongside it. The commotion in the water, however, was so great as to cause the lumps and lighters to pitch and roll at a great rate. The whole surface of the sea for several hundred yards round was presently covered with dead fish and small fragments of the cylinder. Amongst these were innumerable tallow candles, and a mass of butter a foot and a half in length, evidently driven up from the purser's store-room. As soon as the vast commotion in the water had subsided, and the boats had returned from the universal scramble for the candles and dead fish, the diver proceeded again to the bottom, and soon reported that the whole stern of the ship had been driven to pieces, and that, so far as he could ascertain, there was now a free and wide channel directly fore and aft the ship, from stem to stern, through which both the flood and ebb tides will rush, and thus the mud with which the hull of the Royal George has been silted for half a century, will be washed out, and the way cleared for Col. Pasley's further operations.

Steam-Engines.—The following engines are now in hand at the works of Messrs. Fawcett & Co. Liverpool, and the three largest nearly completed:

1	pair of	540	horse power	for the "President."
1	"	420	"	" "United States."
1	"	450	"	for a French man-of-war steam frigate.
1	"	300	"	for H. M. S. "Medina."
1	"	50	"	for the "Calcutta Steam-tug."
1	"	45	"	for a Government tender.
1	single engine of	60	horse power	for Australia.
1	"	50	"	for a French house.

The President's Engines.—These are the most remarkable for their size, and are really a stupendous piece of workmanship. They are already fixed up, and strike the visitor with astonishment. The castings and all the workmanship are of the first description, and the architectural design of the frame-work or pillars is highly ornamental, without any sacrifice to the requisite strength. As probably the most suitable to attain this desideratum, the Gothic style has been adopted. The massy clustered pillars are surmounted by the pointed and moulded arch to correspond. The diagonal stays and their open work are in keeping; and such is the height and imposing effect of the whole, that

visitors generally remarked that it strikingly resembled a handsome Gothic chapel. The beams are beautiful castings, as are the cylinders, and both of immense size and weight. The polished iron and brass work is superb, and the whole furnishes a gratifying proof of at once the enterprise and the ingenuity of the men of England. The following are some interesting statistics of this stupendous piece of machinery:

Diameter of cylinder, ...	80 inches.
Stroke of engine,.....	7 feet 6 inches.
Weight of cylinders,.....	11 tons.
Valve-cases, from	6 to 6½ tons.
Beams (4 in number), upwards of ..	5 tons each.
Condensers, about.....	10 tons.
Gothic pillars (4 pairs), each	11 tons 7 cwt.
Diagonal stays (4 in number), each,	4 tons.
Main or paddle shaft, ...	9 tons.
Two eduction pipes, each	18 cwt.
Boilers, each	30 tons.
Bed-plates, (2) each in one casting,	15 tons.

The whole engines and boilers, with the water, will weigh about 510 tons.

The hoisting tackle used in setting up these engines is well worthy of notice. On the principals, or lower beams of the roof, which are of extraordinary strength, railways are fixed, upon which traverse scaffolds, railed round, and each carrying a powerful winch. On these scaffolds are also railways, at right angles with those on the beams, so that, by moving the scaffolds and the winches, any spot in the building may be attained directly perpendicular to the article to be hoisted, which, by other movements, can be lowered to any given site.

Liverpool Standard.

A new and effectual method to Kyanise Timber.—Within the last two or three weeks, the Manchester and Birmingham Railway Company have commenced Kyanising their wood sleepers in a much more quick and effectual manner than by the old mode of simply depositing the timber immersed in the prepared liquid. The Company have had made a large iron cylindrical vessel, weighing about ten tons, and which is about thirty feet long, and six or seven feet diameter, made from wrought-iron plates ⅝ths thick, and double riveted, which vessel is capable of resisting a pressure of 250 lbs. on the inch. The vessel being filled as compactly as possible with wood sleepers, 12 inches broad and 7 inches thick, the liquid is then forced in with one of Bramah's hydraulic pumps, and worked by six men to a pressure of 170 lbs on the inch. By this means the timber is completely saturated throughout in about ten hours, which operation, on the old system, took some months to effect.

Extraordinary manner of Manufacturing Cloth.—A gentleman, residing at present in London, has just obtained, we are told, a patent for making the finest cloth for gentlemen's coats, &c. without spinning, weaving, or indeed without the aid of any machinery similar to those processes, and at a cost less than one-fourth the present price. The most extraordinary circumstance in this contrivance is, that air is the

only power used in the manufacture of the article. The ingenious inventor places in an air-tight chamber a quantity of flocculent particles of wool, which by means of a species of winnowing-wheel are kept floating equally throughout the atmosphere contained therein; on one side of the chamber is a net-work of metal of the finest manufacture, which communicates with a chamber from which the air can be abstracted by means of an exhausting syringe, commonly called an air-pump, and on the communication between the chambers being opened, the air rushes with extreme vehemence to supply the partial vacuum in the exhausted chamber, carrying the floccula wholly against the netting, and so interlacing the fibres that a cloth of a beautiful fabric and close texture is instantaneously made. Several of the specimens of this cloth that have been shown to scientific gentlemen and manufacturers have excited great admiration. This cloth is a species of felt; but instead of adopting the old laborious method, the above, which is denominated the pneumatic process, is used, and produces the result as it were by magic. Observer.

Porcelain Letters.—A patent has lately been taken out for an invention to supersede the ordinary wooden letters usually fixed upon the facia of shop windows. The new letters are made of porcelain, of every form and hue, and when fixed up present a beautiful and attractive appearance. The facility of cleansing them is not the least of their qualifications; for with a sponge they are immediately brought to their pristine beauty and elegance. It is stated that they will not exceed the old wooden letters in price. Some of the patterns are very elegant, particularly the golden ones; and being glazed, present a dazzling and animated appearance. They are not quite ready for public use; but it is expected they will soon arrive from the manufactory in Staffordshire.

DESCRIPTION OF AMERICAN PATENTS

Granted from June 12th to July 10th, 1840.

Improvement in the Ponton Equipage for Military and other operations.
By E. M. Huntington, adm'r of John F. Lane, Terre Haute, Ind. June 17th.

Claim.—What is claimed as new therein is the constructing of ponton bridges by combining together the pontons such as are herein described, and the necessary string-pieces and planking, as set forth; and also the combining together of such pontons as herein described, so as to form floating batteries, or floats or rafts, for the conveyance of arms or troops, or for other purposes appertaining to military operations.

Improvement in the Machine for ironing and pressing Hats, Bonnets &c.
By Richard Murdoch, Baltimore, Md. June 17th.

Claim.—What I claim as my invention, and desire to secure by letters patent, consists:

1. In the combination of the shaft I, the curved arm *h*, right-angled lever *g*: the hands *f*1, *f*2, and ratchet-wheel, in the manner herein

described; and these thus combined, I claim the combination with the lever H, and pressing-box K, for the purpose and in the manner described.

2. The method of adjusting the block on which the bonnet is placed, by means of the shaft attached to the face of the ratchet wheel with a universal joint, and the sliding box in the forked seat provided with a set screw, as herein described.

3. The arrangement of the swinging table on which the front is pressed, as before described.

Improvement in Bathing Apparatus. By GEORGE J. BYRD and PETER MILNE, New-York. Issued June 17th, 1840; antedated February 8th.

CLAIM.—What we claim as our invention, and desire to secure by letters patent, is the compound standing pipe as shown and described in the drawings and model, together with the mode of supplying hot and cold water to bathing tubs by means of the compound standing-pipe &c. and the combination with the same as the overflow pipe; the whole being constructed in the manner and for the purpose described.

Improvement in the construction of Stoves and Kettles for making Varnish &c. By HARMAN HIBBARD, Attica, N.Y. June 17th.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, is the constructing of stoves for making varnish or other purpose with a moveable furnace, moved, raised or lowered by hand, lever, crank, spring or other similar arrangement, so as to regulate the distance of the fire from the kettle or other utensil to which the heat is to be applied; likewise the application of the stirring tube, and concave lid to, or their combination with the varnish kettle, as set forth in the specification.

Improvement in Kilns for Burning Brick. By HENRY READ, Kensington, Pa. June 17th.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, is the above described manner of setting the bricks in a kiln, for the purpose of burning: that is to say, I claim the leaving of flues for the free passage of the flame and draught between every two or three lengths of bricks, said flues extending from arch to arch throughout the whole length of the kiln, and being arranged and constructed substantially in the manner herein set forth.

Improvement in the mode of Warming Buildings, by converting Hollow Walls into Flues. By JOHN A. STEWART, Philadelphia. June 17th.

CLAIM.—What I do claim as constituting my invention, and desire to secure by letters patent, is the formation of the spaces between such double walls into flues, in such a manner as that the draught from fireplaces or stoves of any kind may be made to pass between said walls in the manner described, whereby they will be kept perfectly dry, and a large portion of the heat usually lost will be conducted and radiated

into the rooms; the whole being constructed and operating substantially as herein set forth.

Improvement in the method of securing the Boxes of Carriage Wheel Hubs to their Axles. By LYMAN SMITH, jr. and GRIFFIN R. WARING, Derby, Ct. June 17th.

CLAIM.—What we claim as our invention, and wish to secure by letters patent, is the method of securing the box or wheel in its place on the axle, by means of the flange *b* 1. of the box, the cap *c* of the axle, and the set screws *d*, or the key *f*, in the manner herein described.

Improvement in Surgeons' Trusses. By W. B. DODSON, Louisville, Ky. June 17th.

CLAIM.—What I claim, &c. is constructing the ventro-inguinal block with a depression on the inner and lower edge and surface of it, so as to admit of the descent of the spermatic vessels without pressure when on the iliac side of the ring. Also, constructing the block for ventral or direct hernia, with a sulcus or depression on its lower and inner edge, so formed that it will rest on Poupart's ligament, and prevent the block from sinking too deeply and its being drawn downwards by the perineal strap, as set forth. I claim also the combination of the checks or guard with the truss spring, as herein set forth.

I claim also the manner in which I have constructed the block for umbilical hernia, by forming it in two pieces, and connecting each of the pieces with the spring of the truss by a curved piece of iron and a regulating screw passing through those pieces, for the purpose of separating or approximating the parts of the divided block so as to produce a greater or less degree of pressure on the hernial sacs or tumor, all as herein set forth.

I also claim the method of treating umbilical hernia by means of a truss constructed and operating substantially in the manner herein set forth.

Improvement in the Whippletree for Carriages. By BENJ. FOWLER, assignee of JAMES JOREY, Stafford, Ct. June 17th.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, is the employment of the yoke in combination with the whippletree and central pin as described, and also the wing-guards in combination with the whippletree, for the purpose and in the manner described.

Improvement in Straw-Cutters. By JOSEPH WORLEY, Hawkins co. Tenn. June 20th.

CLAIM.—What I claim as my invention, is my plan of giving to the knife an oblique or draw cut, by means of the vibrating beams to which the knife is attached, and operated as above described. Also, the means by which press-piece *n* is made to operate, consisting of the combination of the spring *o*, the lever *r*, and the connecting rod *q*, acted upon by the cam *p*, and the fly-wheel, as above described. Also, the particular manner in which I have combined said press piece, hopper and knife, as herein set forth.

Improvement in the ordinary Argand Oil-Burner, for adapting it to burn Spirits of Turpentine. By CHAS. CARR, Philadelphia. June 20.

CLAIM.—What I claim therein as constituting my improvement, and which I desire to secure by letters patent, is the manner in which I have connected and combined the sliding tube *c c* with the ordinary Argand's oil-burner, so as to adapt it to the burning of the spirits of turpentine and the raising of the wick, as set forth.

Improvement in Mowing Machines. By SETH LAMB, New-York. June 20th.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, is the bows or guards K, in combination with the guides or rests G, sickles H, and the outer guards E and F; the same being constructed in the manner and for the purpose as before described.

I also claim the platform R, the same being constructed and used for the purpose as herein before described.

I further claim the placing of the sickle-wheel B and its appendages at the inner side of the machine, so as to permit the horse to travel by the side of the grain in front of the machine, and to allow the platform R to extend by the side of it for carrying the grain, substantially as before described.

Improvement in the mode of arranging the Flues and governing the Draft in Cooking Stoves. By CHARLES GUILD, Cincinnati, Ohio. June 20th.

CLAIM.—What I claim therein as constituting my invention and improvement, is the manner in which I have combined and arranged the three partitions dividing the flue space into four compartments, excepting at the front where the two lateral partitions terminate, in the manner and for the purpose set forth; and I also claim, in combination, the partitions so arranged, the employment of the dampers D and P, operating substantially as described. I do not claim either of these parts separately or individually, but only in combination as above.

Improvement in the mode of communicating information by Signals, by the application of Electro-Magnetism. By SAMUEL F. B. MORSE. June 20th.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, is as follows:

1. The formation and arrangement of the several parts of mechanism constituting the type-rule, the straight port-rule, the circular port-rule, the two signal-levers and the register-lever, and alarm-lever with its hammer, as combining respectively with each of said levers, one or more armatures of an electro-magnet, and as said parts are severally described in the foregoing specification.

2. The combination of the mechanism constituting the recording cylinder, and the accompanying rollers and train-wheels, with the formation and arrangement of the several parts of mechanism, the formation and arrangement of which are claimed as above, and as described in the foregoing specification.

3. The use, system, formation and arrangement of type and of signs for transmitting intelligence between distant points, by the application of electro-magnetism and metallic conductors combined with mechanism, described in the foregoing specification.

4. The mode and process of breaking and connecting by mechanism currents of electricity or galvanism, in any circuit of metallic conductors, as described in the foregoing specification.

5. The mode and process of propelling and connecting currents of electricity or galvanism in and through any desired number of circuits of metallic conductors, from any known generator of electricity or galvanism, as described in the foregoing specification.

6. The application of electro-magnets, by means of one or more circuits of metallic conductors from any known generator of electricity or galvanism to the several levers in the machinery described in the foregoing specification, for the purpose of imparting motion to said levers and operating said machinery, and for transmitting by signs and sounds intelligence between distant points, and simultaneously to different points.

7. The mode and process of recording or marking permanently signs of intelligence transmitted distant to points, and simultaneously to different points, by the application and use of electro-magnetism, or galvanism, as described in the foregoing specification.

8. The combination and arrangement of electro-magnets in one or more circuits of metallic conductors with armatures of magnets, for transmitting intelligence by signs and sounds, or either, between distant points, and to different points simultaneously.

9. The combination and mutual adaptation of the several parts of the mechanism and system of type and of signs, with and to the dictionary or vocabulary of words, as described in the foregoing specification.

Improvement in the construction of Churns. By ALLEN CROWELL and WILLIAM A. CROWELL, Litchfield, Ct. June 20th.

CLAIM.—What we claim as new, and as our own invention or discovery, and desire to secure by letters patent, is the combination of tin and wood, or other metal and wood, or all metal, in the formation of a chamber or space in the lower part of the churn, as herein described, or joining any part or parts of the herein described churn, or any churn not herein described where a metal division plate is used in the formation of a chamber or space made in any shape or form which constitutes a chamber or space, with a metal division plate, for the purpose of bringing the milk or cream to the proper degree of heat required easily and rapidly to the will, by means of filling the chamber or space with hot water or other liquids when the milk or cream requires to be warmed, or cold water when it requires to be cooled, so that the temperature of the milk or cream will rapidly become the temperature of the water contained in the chamber or space. The division plate is to be made of tin or other metals which will not become oxidized by the action of the acid contained in the milk or cream, so as to become injurious to the butter when churned, or otherwise injurious to the churn; the bottom plate can be made of the same metal as division plate, or any metal which will not become oxidized by water.

The herein described churn can be varied in size, according to the milk or cream to be churned. For using the churn herein described, the dash being placed in the churn, and the spindle screwed in, put in the milk or cream to be churned; if not in the right degree of heat, apply the hot or cold water in the chamber or space under the milk or cream until it becomes the right degree of heat required, being about 60 degrees: the degree of heat can be correctly ascertained by a thermometer made for tempering liquids, by being placed in the milk or cream, or formed in the end of the churn, the card of the thermometer on the outside of the churn, the tube being crooked, so that the bulb will pass nearly through the end-piece, and come in contact with the milk or cream sufficiently to ascertain the temperature, the card on the outside showing the temperature of the milk or cream in the inside of the churn; turn the crank from 30 to 50 revolutions a minute; it becomes necessary sometimes, to gather the particles of butter, to turn the dash half round and back a few times, until sufficiently gathered. The churn can be used either with or without a thermometer.

Improvement in the Mortising and Tenoning Machine. By ANDREW BAILEY, Jefferson, Ashtabula co. Ohio. June 20th.

CLAIM.—I do not claim as my invention the employment of a swivel in the chisel rod for the purpose of turning the chisel; but what I do claim as my invention is the combination of the swivel, chisel stock, chisel rod, and spiral spring catch, constructed and operating all as herein described.

Improvement in Cheese-Presses. By J. A. FLETCHER, Irasburg, Orleans co. Vt. June 20th.

CLAIM.—What I claim therein as constituting my invention, and desire to secure by letters patent, is the so forming and combining the respective parts as herein described, that the whole press with its load shall be suspended by the longer arms of the levers C C, and the shorter arms be thereby caused to act upon the follower, substantially as set forth.

Improvement in the management of the Draft &c. in Cooking Stoves. By HORACE STRICKLAND, Bradford, Vt. June 27th.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, in the above described stove, is the particular manner in which I have arranged the flues around the oven, by dividing the upper flue into three parts, and governing the passage of the draft through the middle section by means of the two dampers, operating as herein set forth. I claim also the manner in which I have combined and connected the furnaces B B with the stove and its flue, for the purpose described.

I do not claim the mere carrying of the flue around the oven, nor the dividing of the upper flue into three sections; this having been before done; nor do I claim the employment of valves or dampers generally; but I limit my claim in these particulars to the spiral arrangement made by me of the said dampers and flues, as herein set forth.

Improvement in the Pit-sawing and Slitting Machine for sawing Logs into Lumber and Boards. By JAMES HAMILTON, N.York. June 27.

CLAIM.—I claim as my invention and improvement the mode above substantially described of mounting the working machinery and moving the same above the log or timber to be sawn, in manner aforesaid or in any other substantially the same, so that the saw works through the log by its own travel, while the log is secured on stationary headstocks nearly on a level with the ground line.

Improvement in Locomotive Steam-Engine. By ASA WHITNEY, Rotterdam, N. Y. June 27th.

CLAIM.—I do claim, in the first place, as my invention and improvement, the combination of the cog or spur wheel, with the two pair of driving wheels nearest to them, in combination with the rod connecting the front and rear wheels with the middle wheels; by which combination of the cog wheels and connecting rods with the driving wheels, the power of the engine is communicated to the whole number of the driving wheels when the engine is put in motion.

I also claim the above method of connecting the wheels of the locomotive, so as to constitute four pair of driving wheels in combination with the frame, extending over both carriages resting on bearings, and supporting the weight of the engine on two separate carriages, as herein set forth, thereby securing the adhesion to the rails of the whole 8 wheels.

Improvement in the manner of constructing Dies for making Door and other Knobs of Plated Metal. By LUCIEN E. HICKS, Middletown, Ct. June 27th.

CLAIM.—What I claim as constituting my invention in the within described dies for manufacturing knobs of plated metal out of one single blank or piece, is the forming of the cup of the lower die with cylindrical sides, and adapting the upper die thereto by forming its outside cylindrically, and of such size as to fit the lower die, whilst the junction of its cylindrical sides and its hollow or cup constitutes a sharp edge, in the manner and for the purpose herein set forth.

I also claim the combining with the lower die the bolt B, with its shoulder *c c*, for the purpose of forming the hole in the knob and of raising it from the die, substantially in the manner set forth.

Improvement in the Machine for Cleaning and Drying Feathers. By JOHN H. STEVENS, assignee of ROBERT B. LEWIS, N.York. June 27.

CLAIM.—What I claim as new and of my own invention, is:

1. The combination of the horizontal steam-pipes *g*, and the circular steam-pipes *g* 1. with the cylinder *c*, and with the means of letting the steam into the cylinder *c*, through the pipes and the cock *m*, and shutting off the same when used for cleansing and drying feathers by steam and steam heat, substantially as the same are describnd.

2. The perforated revolving cylinder E, in combination with the slide frame *b*, and slide-ways *p*, when used for dusting feathers, and cleansing and drying the same by steam and steam heat, substantially as the same are described.

3. The combination of the shifting frame *B*, with the shaft *a*, and shifting end *D*, and cylinder E, when used in the process of cleansing feathers, substantially as the same are described.

Improvement in the Apparatus for purifying Gas for illumination. By DANIEL GAMET, Richfield, N. Y. June 27th.

CLAIM.—What I claim as constituting my invention in the above described apparatus, is the particular manner in which I have connected and combined the cylinders A, B and D, with the tubes leading into and from them, so as to cause the gas generated from wood for the purpose of illumination to pass through the respective tubes and cylinders, in the manner and for the purpose set forth.

Improvement in Seed Planter. By THOMAS J. LEWIS and GEORGE F. LEWIS, Boston, Mass. June 27th.

CLAIM.—We claim the combination of the revolving circular plate, constructed and operated as above described, with the brush, conducting pipe, and hole in the side of the hopper, as above set forth, for the purpose of measuring out and distributing the seed to the furrow, and also our arrangement by which we form a box or inclosure for the seed (when in opposition with the conducting pipe) with three sides only, which greatly facilitates the dropping of the seed.

Improvement in the Screw-Wrench. By HAWLEY D. CLAPP, assignee of HENRY W. HEWET, New-York. June 27th.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, is cutting the male screw upon the tube C, which revolves upon the main bar A, in combination with the nut D, attached to the jaw E, as herein described.

Machine for Breaking Stone for the purpose of Macadamizing Roads, and for other purposes. By NICHOLAS COOPER, Jun. TOWNSEND McCONNEL, and WM. E. LUKENS. June 27th.

CLAIM.—What we claim as our invention, and desire to secure by letters patent, is the combination of the rotary hammers, fixed or swinging, with the bars Q as herein described, and in combination therewith the grating M, and battery B, for the purpose and in the manner described.

Improvement in the construction of Seed-Planters. By THOMAS J. LEWIS and GEORGE F. LEWIS, Boston, Mass. June 27th.

CLAIM.—1. We claim a rotary plate, *larger in diameter than the hopper*, and formed with valves under each beveled aperture or seed receptacle (to keep the seed from clogging or getting under the plate) in combination with a hopper, which is pressed down on the upper surface of said rotary plate (in order to prevent the seed from escaping during the revolution of the plate) by a spring as above described, the whole being arranged and operating together substantially in the manner and for the purposes herein before set forth.

2. We claim the peculiar combination of the machinery which revolves the horizontal plate, and thereby regulates the dropping or discharge of the seed from the hopper; said combination consisting of the series of toothed or gear wheels P S T, moveable pinion O on the shaft M, endless screw L, and pinion K attached or connected to the arbor I of the horizontal plate; the whole being arranged and operating together substantially in the manner and for the purposes herein before set forth and described.

Improvement in the art of Hydrographic Surveying. By H. A. Norris, New-York. June 27th.

Claim.—What I claim as my invention, and desire to secure by letters patent, is as follows:

1. The method herein described of enabling the bearings or angles of the boat or moving body to be taken at the same instant, from the extremities of one or more base lines, by the use of time-keepers and signals arranged and operated upon the principle herein set forth; the principal object of which arrangement is to determine the boat or moving body's position without stopping its progress; thus executing the survey more rapidly.

2. In combination with the foregoing, the method herein described of enabling the soundings (or other notices and examinations of the surveyor accompanying the moving body) to be made at the same instant the angles are taken, by the employment of a time-keeper for ascertaining the times previously agreed on at which the soundings (or other examination) should be taken and the angle measured.

Improvement in the Machine for sawing or cutting Snags. By James Hamilton, New-York. June 27th.

Claim.—I do claim as my invention and improvement the application of said saw above substantially described for the purposes aforesaid, in combination with the shaft, cheeks or side-pieces, division plates and circular bars or guides, as above and substantially described.

Improvement in Galvanic Paint for protecting Iron from Rust &c. By Lewis Knapp, New-York. July 1st.

Claim.—What I claim as new, and of my own discovery and invention is:

1. Forming of a galvanic paint for coating utensils of iron, by pouring a mixture of lead and zinc, or lead, zinc and tin, on a quantity of copperas and sal ammonia placed in the bottom of a vessel, so as to form an oxide of said metals, and afterwards combining with the oxide so formed a further quantity of copperas and sal ammonia, all as herein set forth.

2. I claim as new, and of my own discovery and invention, the combination of a portion of lime with the galvanic powder so produced, when such combination is used for the purpose of economizing the galvanic powder, and making the paint so mixed harder and more adhesive, substantially in the manner herein before set forth.

3. I claim as new and of my own discovery and invention, the mode herein set forth of forming an alloy of zinc and lead, or of zinc, lead and tin, by pouring a mixture of said metals in a melted state on a quantity of copperas and sal ammonia, which unites with the grosser parts, and allows the purer parts to escape through the bottom of the vessel, as herein set forth.

Improvement in the mode of constructing the Heels of Boots and Shoes. By SAMUEL WARNER of Lowell, JERE. HODGKIN of Westfield—both of Orleans co. Vt.; and WILLIAM E. TRAVER, of Watervliet, Albany co. N. Y. July 1st.

CLAIM.—What we claim as our invention, and desire to secure by letters patent, is the manufacturing and attaching metallic, iron, bone or ivory heel-cases to the hollow part below the flange to be filled up with india-rubber, cork or leather, or any other suitable material, and combining therewith or attaching thereto a spur when necessary, as herein before set forth.

Improvement in Coupling Irons for Railroad and other Carriages. By THOMAS G. OWEN, Baltimore, Md. July 1st.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, is the method of coupling railroad cars or carriages &c. by means of the double coupling irons in combination with the sliding bar, for the purpose and in the manner substantially as herein described.

Improvement in the mode of arranging the Cylinders in Double-cylinder Engines, for preventing a "dead point" on the Crank. By CALEB L. FERRIS, Cortland, N. Y. July 1st.

CLAIM.—What I claim as my invention, and desire to have secured by letters patent, is the manner in which I have arranged and combined the horizontal and vertical cylinders; that is to say, I claim placing said cylinders (whether one be horizontal and the other vertical, or otherwise, providing their relation to each other be still the same) at right angles or nearly so with their closed ends adjoining each other, and the crank or main shaft between them at the junction of the angle, and the operating the cranks by means of having the connecting rods of both cylinders attached to them.

Improvement in the Door-Spring for closing Doors, Gates, &c. By GARDNER BARTON, Jr. Shaftsbury, Vt. July 1st.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, is the combination and arrangement of the spring, rack, segment and lever, and the roller F attached, or working on the standard shaft E, in the manner and for the purpose described.

Improvement in the Machine for removing Earth &c. By JARVIS RING, Ogden, N. Y. July 1st.

CLAIM.—What I claim as my invention, and desire to secure by letters patent is the making a double railway with one track above the

other, and rounded off at the ends to unite the two, so that cars attached to endless chains or belts can run upon the two tracks for the purposes and in the manner described.

Improvement in the Cylinder Mill, for grinding Corn and other Grain. By HARVEY W. PITTS, Wilsonville, Alabama. July 1st.

CLAIM.—What I claim as my invention, and which I desire to secure by letters patent, is the double vibrating concave in combination with the fast and slow moving cylinders for grinding grain, as herein set forth.

Improvement in Steel Writing-Pens. By DAVID THOMAS, Hingham, Mass. July 3d.

CLAIM.—What I claim as my invention, and which I desire to secure by letters patent, is the before described mode of making the steel writing-pen of two pieces of steel, with firm unelastic nibs, the elasticity being produced above the nibs, and suspending the same in a tube or holder by pivots crossed at angles and turning in cavities in two of the angles of said tube, and in the points of set screws passing through the other angles, by which the pen is properly adjusted for writing; and also the two stops or points in the tube for holding the shanks of the springs in their proper places, as described. Also, in covering the holder with leather, gum caoutchouc, a stuffed cushion, or any other elastic substance.

Improvement in the Machine for Drilling or Boring Rock and other substances. By SIMON PETTES, Schenectady, N.Y. July 3d.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, is the combination of the inclined adjustable and sliding frames E U, with the drill *a*, as constructed, in the manner described, and also the method of raising and turning the drill by means of the cogs or cams c^2 on the plate *b*, and the tappets *e* on the shaft *d*, as herein described.

Improvement in the construction of Screw-Nuts to be applied to Files for filing Papers, Accounts, &c. By WILLIAM MANN, Philadelphia. July 3d.

CLAIM.—Now, what I claim as my invention or improvement is the construction of the divided spring screw-nut, opening by the elasticity of the springs attached to the two halves of the nut, and united at *b*, and made to close by means of the sliding ring, and adapted in the manner above described to the file for filing letters and other papers.

Improvement in the mode of attaching Artificial Teeth. By ALFRED RIGGS, New-York. July 3d.

CLAIM.—I rest my claim to invention or improvement in the making or manufacture of bases or plates for mounting artificial teeth, upon the making or forming them of two parts or plates, closely united together at the edges, so as to be air-tight, with a space, cavity or hollow between

the plates, either continuous or divided into apartments. The inner plate which rests upon the gums being perforated with holes more or less in number, through which the air is exhausted from the space, hollow or cavity between the plates by suction or otherwise, thus causing the bases to adhere to the gums by the pressure of the atmosphere or air from without.

Improvement in the Cotton Gin. By JONES MCCARTHY, Demopolis, Alabama. July 3d.

CLAIM.—What I claim as my invention, and which I desire to secure by letters patent, consists in the arrangement of the vibrating saw C, grated hopper B, adjustable plate M, and grooved drawing-roller N, for separating the seed from cotton, in combination with the receiving roller S, and the advancing and receding comb X for discharging it, as herein set forth.

Improvement in the mode of applying distemper colors, having albumen or gelatin for the vehicle, so as to render the same more durable, and preserving the same when not wanted for immediate use. By FRANCIS GYBBON SPILSBURY, FANNY CORBAUX, and ALEXANDER S. BYRNE, Great Britain. Patented 7th Oct. 1839, England; issued 10th July, 1840, in America.

CLAIM.—What we claim is:—1. The mode of employing paints or pigments and soluble vehicles, gelatin and albumen, by afterwards rendering such paints or pigments and vehicles insoluble, as above described.

2. We claim as a new manufacture the combining pigments with gelatin and albumen, in a dry mass or in a paste, with suitable materials for preserving the latter from decomposition, in order to allow of keeping the paints or pigments so prepared, in order to their being transported from place to place, and only require to be rendered liquid by hot soft water for use when gelatin is employed as the vehicle, and cold soft water when albumen is employed.

3. We claim as a new manufacture the mode of preparing pigments with resinous matters, or wax dissolved in an alkaline ley or solution of borax, made into a thick paste (or dry) and thus to allow of the prepared pigment being transported from place to place, and only requiring hot soft water to liquify it for use.

4. We claim the mode herein described of applying pigments, paints and soluble vehicles, wax or resinous matter dissolved in an alkaline ley or borax, by afterwards rendering such paints or pigments and vehicles insoluble, as above described.

5. We claim the mode of combining of soluble salts of zinc, magnesia and lead with gelatin, in order to preserve the same.

6. We claim the mode of combining of soluble salts of zinc, magnesia and lead combined with pigments, as herein described.

7. We claim the mode herein described of preparing and applying paints or pigments and vegetable products, by rendering such paints or pigments and vehicles insoluble, as above described.

8. We claim the combining pigments with vegetable products and preserving materials, as above described. And

other, and rounded off at the ends to unite the two, so that cars attached to endless chains or belts can run upon the two tracks for the purposes and in the manner described.

Improvement in the Cylinder Mill, for grinding Corn and other Grain. By HARVEY W. PITTS, Wilsonville, Alabama. July 1st.

CLAIM.—What I claim as my invention, and which I desire to secure by letters patent, is the double vibrating concave in combination with the fast and slow moving cylinders for grinding grain, as herein set forth.

Improvement in Steel Writing-Pens. By DAVID THOMAS, Hingham, Mass. July 3d.

CLAIM.—What I claim as my invention, and which I desire to secure by letters patent, is the before described mode of making the steel writing-pen of two pieces of steel, with firm unelastic nibs, the elasticity being produced above the nibs, and suspending the same in a tube or holder by pivots crossed at angles and turning in cavities in two of the angles of said tube, and in the points of set screws passing through the other angles, by which the pen is properly adjusted for writing; and also the two stops or points in the tube for holding the shanks of the springs in their proper places, as described. Also, in covering the holder with leather, gum caoutchouc, a stuffed cushion, or any other elastic substance.

Improvement in the Machine for Drilling or Boring Rock and other substances. By SIMON PETTES, Schenectady, N.Y. July 3d.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, is the combination of the inclined adjustable and sliding frames E U, with the drill *a*, as constructed, in the manner described, and also the method of raising and turning the drill by means of the cogs or cams c^2 on the plate *b*, and the tappets *e* on the shaft *d*, as herein described.

Improvement in the construction of Screw-Nuts to be applied to Files for filing Papers, Accounts, &c. By WILLIAM MANN, Philadelphia. July 3d.

CLAIM.—Now, what I claim as my invention or improvement is the construction of the divided spring screw-nut, opening by the elasticity of the springs attached to the two halves of the nut, and united at *b*, and made to close by means of the sliding ring, and adapted in the manner above described to the file for filing letters and other papers.

Improvement in the mode of attaching Artificial Teeth. By ALFRED RIGGS, New-York. July 3d.

CLAIM.—I rest my claim to invention or improvement in the making or manufacture of bases or plates for mounting artificial teeth, upon the making or forming them of two parts or plates, closely united together at the edges, so as to be air-tight, with a space, cavity or hollow between

the plates, either continuous or divided into apartments. The inner plate which rests upon the gums being perforated with holes more or less in number, through which the air is exhausted from the space, hollow or cavity between the plates by suction or otherwise, thus causing the bases to adhere to the gums by the pressure of the atmosphere or air from without.

Improvement in the Cotton Gin. By JONES MCCARTHY, Demopolis, Alabama. July 3d.

CLAIM.—What I claim as my invention, and which I desire to secure by letters patent, consists in the arrangement of the vibrating saw C, grated hopper B, adjustable plate M, and grooved drawing-roller N, for separating the seed from cotton, in combination with the receiving roller S, and the advancing and receding comb X for discharging it, as herein set forth.

Improvement in the mode of applying distemper colors, having albumen or gelatin for the vehicle, so as to render the same more durable, and preserving the same when not wanted for immediate use. By FRANCIS GYBBON SPILSBURY, FANNY CORBAUX, and ALEXANDER S. BYRNE, Great Britain. Patented 7th Oct. 1839, England; issued 10th July, 1840, in America.

CLAIM.—What we claim is:—1. The mode of employing paints or pigments and soluble vehicles, gelatin and albumen, by afterwards rendering such paints or pigments and vehicles insoluble, as above described.

2. We claim as a new manufacture the combining pigments with gelatin and albumen, in a dry mass or in a paste, with suitable materials for preserving the latter from decomposition, in order to allow of keeping the paints or pigments so prepared, in order to their being transported from place to place, and only require to be rendered liquid by hot soft water for use when gelatin is employed as the vehicle, and cold soft water when albumen is employed.

3. We claim as a new manufacture the mode of preparing pigments with resinous matters, or wax dissolved in an alkaline ley or solution of borax, made into a thick paste (or dry) and thus to allow of the prepared pigment being transported from place to place, and only requiring hot soft water to liquify it for use.

4. We claim the mode herein described of applying pigments, paints and soluble vehicles, wax or resinous matter dissolved in an alkaline ley or borax, by afterwards rendering such paints or pigments and vehicles insoluble, as above described.

5. We claim the mode of combining of soluble salts of zinc, magnesia and lead with gelatin, in order to preserve the same.

6. We claim the mode of combining of soluble salts of zinc, magnesia and lead combined with pigments, as herein described.

7. We claim the mode herein described of preparing and applying paints or pigments and vegetable products, by rendering such paints or pigments and vehicles insoluble, as above described.

8. We claim the combining pigments with vegetable products and preserving materials, as above described. And

Lastly, we claim the mode of preparing pigments or paints and vegetable products with silicate of potassa or soda, or other materials having the property of rendering the painted surface insoluble in water, as above described.

Improvement in the construction of Stoves for heating the air of apartments. By GEORGE C. HOWE, New-York. July 10th.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, consists in the manner in which I have combined the cylindrical stove and drum, by making the drum surround the back part of the cylinder, and leave an open space between it and the latter for a current of air to circulate through, as described. Also, the mode of conducting or changing the draft by means of the flues E and I, and the valves F and J, in combination with the foregoing arrangement of the drum and cylinder as described, which causes the draft to pass directly from the fire chamber to the chimney, by closing the valve J and opening the valve F, or to circulate through the semicircular drum before passing to the chimney, by closing the valve F and opening valve I, as herein set forth.

Improvement in the method of hanging Doors. By WM. D. BEASOM and ELBRIDGE G. REED, assignees of GEORGE W. WILSON, Nashua, N. H. July 10th.

CLAIM.—Having thus described and set forth the nature of my improvements, I shall claim in the same the construction of the upper hinge in combination with the lower hinge, arranged and operating together substantially in the manner and for the purposes herein above described.

Machine for making Card Paper. By EDWARD L. PERKINS, Boston, Mass. July 10th.

CLAIM.—What I claim as my invention, and desire to have secured by letters patent, is the arrangement of the barrels, belts and rollers which carry the sheet of paper to receive the paste, in combination with the brush *e*, and the brush *i*, and the bed and reservoir of paste. I also claim this arrangement in combination with the roller which carries the second sheet of paper, and with the pressing rollers; and this last combination I also claim in combination with the brush *e*, for laying on the paste, all as herein described.

Improvement in the method of greasing, and keeping dust, &c. out of the Boxes of Carriage-wheel Hubs. By NATH'L C. DAY, Lunenburgh, Mass. July 10th.

CLAIM.—I claim as my invention and ask a patent for the axletree-box of the wheel of wheeled vehicles, constructed by the combination of the conical periphery of the washer, the grease reservoir, the flanch of the box, and the gravel guard as above described. I do not claim either of these improvements separately, though the construction of the washer and the box-flanch are my improvements; but I consider their utility as depending on their combination as above.

Improvement in Locomotives for consuming sparks. By FRANCIS B. LONGMIRE and H. JONES BROOKE, Philadelphia. July 10th.

CLAIM.—What we claim therein, and desire to secure by letters patent, is the extending of the exhaust steam-pipes downwards and into a flue passing horizontally along under the boiler, into a compartment in the lower end of the fire-box, which compartment may consist of the ash-pit, or of one specially prepared for the purpose, substantially in the manner set forth.

We also claim the manner set forth of locating and using a water box, constructed in the way and employed for the purpose herein described.

Improvement in the method of making and attaching Metallic Buttons to Clothes. By FESTUS HAYDEN, Waterbury, Ct. July 10th.

CLAIM.—What I claim as my invention, is the method of attaching buttons to cloth by riveting, and of manufacturing the parts for that purpose, combined in the manner substantially as specified above.

Improvement in the mode of forming Blocks for Wooden Pavements, &c. By REDWOOD FISHER, assignee of Aug. Count de Lisle, ———. July 10th.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, is: First, the mode of forming or shaping materials or substances for building, paving and other purposes, according to the division of the cube herein described; 2dly, the mode of employing in combination, for building, paving and other purposes, blocks, materials or substances so formed or shaped.

Improvement in the construction of Refrigerators. By JOHN SCOTT, Philadelphia. July 10th.

CLAIM.—What I claim as new therein, and as of my invention, is the forming it with an upper and lower chamber, in the manner described, the upper chamber being intended to contain ice, and the lower to receive the water produced by the melting thereof; said water descending from the upper to the lower chamber, through tubes or channels constructed substantially in the manner set forth, so as in its descent to exert its refrigerating influence with the refrigerator.

LIST OF ENGLISH PATENTS

Sealed between the 26th April and 26th May, 1840.

William Crane Wilkins, of Long-acre, lamp manufacturer, and Mathew Samuel Kendrick, of the same place, lamp-maker, for certain improvements in lighting and in lamps. April 28; six months to specify.

John Inkson, of Ryder-street, St. James's, gent. for improvements in apparatus for consuming gas for the purpose of light, being a communication from abroad. April 30; six months.

Orlando Jones, of the City-road, accountant, for improvements in

treating or operating on farinaceous matters, to obtain starch and other products, and in manufacturing starch. April 30; six months.

William Peirce, of James-place, Hoxton, ironmonger, for improvements in the construction of locks and keys. May 2; six months.

Arthur Wall, of Bermondsey, surgeon, for a new composition for the prevention of corrosion in metals, and for other purposes. May 2; six months.

Thomas Gadd Matthews, of Bristol, merchant, and Robert Leonard of the same place, merchant, for certain improvements in machinery or apparatus for sawing, rasping, or dividing dyewoods or tanner's bark. May 5; six months.

William Newton, of Chancery-lane, patent agent, for an improved apparatus and process for producing sculptured forms, figures or devices in marble and other hard substances, being a communication from a foreigner residing abroad. May 5; six months.

George Mackay, of Mark-lane, ship-broker, for certain improvements in rotary engines, being a communication from abroad. May 5; six months.

William Beetson, of Brick-lane, Old-street, brassfounder, for improvements in stuffing boxes applicable to water-closets, pumps and cocks. May 5; six months.

Frank Hills, of Deptford, manufacturing chemist, for certain improvements in the construction of steam-boilers and engines, and of locomotive carriages. May 5; six months.

Bernard Aubé, of Coleman-street Buildings, gent. for improvements in the preparation of wool for the manufacture of woolen and other stuffs. May 7; six months.

Thomas Walker, of Gallashiels, Selkirk, mechanic, for improvements in apparatus applicable to feeding machinery, employed in carding, scribbling, or teazing fibrous materials. May 7; six months.

Henry Holland, of Darwin-street, Birmingham, umbrella furniture maker, for improvements in the manufacture of umbrellas and parasols. May 7; six months.

Henry Montague Grover, of Boveney, Buckingham, clerk, for an improved method of retarding and stopping railway trains. May 9; six months.

Miles Berry, of Chancery-lane, patent agent, for certain improvements in treating, refining and purifying oils, being a communication from abroad. May 9; six months.

Auguste Moinan, of Philpot-terrace, Edgeware-road, clock-maker, for certain improvements in the construction of time-keepers. May 9; six months.

Rice Harris, of Birmingham, gent. for certain improvements in cylinder plates and blocks, used in printing and embossing. May 12; six months.

George John Newbery, of Cripplegate-buildings, manufacturer, for certain improvements in rendering silk, cotton, woolen, linen and other fabrics water-proof. May 12; six months.

Henry Dircks, of Liverpool, engineer, for certain improvements in the construction of locomotive steam-engines, and in wheels to be used on rail and other ways, parts of which improvements are applicable to steam engines generally. May 12; six months.

John Davidson, of Leith-walk, Edinburgh, for an improvement in the method of preserving salt. May 12; six months.

Peter Bradshaw, of Dean, near Kimbolton, Bedford, gent. for improvements in dibbling corn and seeds. May 12; six months.

James Walton, of Sowerby Bridge, Halifax, cloth-dresser, for improvements in the manufacture of beds, mattrasses, pillows, cushions, pads and other articles of a similar nature, and in materials for packing. May 12; six months.

Richard Foote, of Faversham, watchmaker, for improvements in alarums. May 12; six months.

John Joseph Mechi, of Leadenhall-street, cutler, for an improved method of lighting buildings. May 12; two months.

Bryan J. Anson, Bromwich, of Clifton-on-Teme, Worcester, gent. for improvements in stirrup-irons. May 13; six months.

Henry Ernest, of Gordon-street, gent. for certain improvements in the manufacture of machines usually called beer-engines. May 13; six months.

William Hannis Taylor, of Norfolk-street, Strand, esquire, for certain improvements in the mode of forming or manufacturing staves, shingles and laths, and the machinery used for that purpose. May 20; six months.

William Bush, of Camberwell, merchant, for improvements in fire-arms and in cartridges, being a communication. May 20; six months.

James Buchanan, of Glasgow, merchant, for certain improvements in the machinery applicable to the preparing, twisting and spinning of hemp, flax and other fibrous substances, and certain improvements in the mode of applying tar or other preservative to rope and other yarns. May 22; six months.

James Callard Davies, of College-place, Camden Town, jeweler, for an improved clock or time-piece. May 23; six months.

LIST OF PATENTS

Granted for Scotland, between 22d April and 22d May, 1840. *Time for specification in each case, four months.*

Orlando Jones, of the City Road, Middlesex, accountant for improvements in treating or operating on farinaceous matters to obtain starch and other products, and in manufacturing starch. Sealed May 6.

Francis Gybbon Spilsbury, of Walsall, Staffordshire, chemist, Marie François Catherine Doetzer Corbaux, of Upper Norton-street, Middlesex, and Alexander Samuel Byrne, of Montague Square, of Middlesex, gentleman, for improvements in paints or pigments and vehicles, and in modes of applying paints, pigments and vehicles. May 7.

Joseph Clinton Robertson, of 166 Fleet-street, London, patent agent, being a communication from abroad, for an improved method or methods of obtaining mechanical power from electro-magnetism, and the engine or engines by which the said power may be made applicable to motive purposes. May 7.

John Wilson, of Liverpool, lecturer on chemistry, for an improvement or improvements in the process or processes of manufacturing the carbonate of soda. May 11.

Antoine Blanc, of Paris, merchant, and Theophile Gervais Bazille, of Rouen, merchant, now residing at Subloniere's Hotel, Leicester-square, Middlesex, being a communication from abroad, for certain improvements in the manufacturing or producing soda and other articles obtained by or from the decomposition of common salt or chloride of sodium. May 11.

Robert Gill Ransom, of Ipswich, paper-maker, and Samuel Milbourn, of the same place, foreman to the said Robert Gill Ransom, for improvements in the manufacture of paper. May 13.

Thomas Myerscough, of Little Bolton, county of Lancaster, manager, and William Sykes, of Manchester, machine maker, for certain improvements in the construction of looms for weaving or producing a new or improved manufacture of fabric, and also in the arrangement of machinery to produce other descriptions of woven goods or fabrics. May 13.

James Knowles, of Little Bolton, county of Lancaster, coal merchant, for an improved arrangement of apparatus for regulating the supply of water to steam boilers. May 13.

Henry Trewhitt, of Newcastle-on-Tyne, esquire, for certain improvements in the fabrication of china or earthenware, and in the machinery or apparatus applicable thereto. May 15.

William Winsor, of Rathbone Place, Middlesex, artists' colorman, for a certain method or certain methods, process or processes, for preparing, preserving and using colors. May 13.

William Craig, of Glasgow, engineer, and William Douglas Sharp, of Stanley, Perthshire, engineer, for certain improvements in machinery for preparing, spinning and doubling cotton, flax, wool and other fibrous substances. May 18.

Alexander Angus Croft, of Greenwich, manufacturing chemist, for certain improvements in the processes of manufacturing gas, and in the production of ammoniacal salts. May 19.

John Davidson, salt manufacturer, Leith-walk, near Edinburgh, for an improvement in the method of preserving salt. May 19.